Fostering Food Literacy and Food Citizienship through Farm-School Cooperation and beyond

Theoretical perspectives and case studies on farm-school cooperation and food and agricultur education

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Fostering Food Literacy and Food Citizenship through Farm-School Cooperation and beyond –

Theoretical perspectives and case studies on farm-school cooperation and food and agriculture education

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Abstracts

In the globalized food systems consumers, especially children, are increasingly disconnected from understanding how and where their food is produced. This has an impact on eating habits and choices, affecting health, the environment, agriculture and other ethical dilemmas such as animal welfare and fair trade. Farm visits and closer collaboration between farmers and teachers through the school can enable children to get a direct understanding and potential interest in how their food is produced, the nature of agriculture and a relationship with the farmers, as an authentic teacher and expert. In my PhD project I investigate various farm-school cooperation arrangements and the motivation, learning goals and values among farmers and teachers working together to promote children's understanding of their food, nature, agriculture and sustainability. The Ph.D. study is based on four case studies and a review of Danish educational materials related to food, agriculture and sustainability.

Results show that what motivates farmers and teachers to collaborate is the ability to give students a closer connection to nature and agriculture as well as an understanding of and interest in food, agriculture and ecology thus ideally qualifying their future consumption choices. Farm visits and students' own experiments in a field are intended to influence their food literacy and ecological and agricultural understanding. Other important learning goals are to contribute to students' social skills, life skills and academic understanding of complex theoretical terms through hands-on real life activities. Farm visits are most effective if they are followed up in the classroom before and after and referred back to later during primary education. Although there are a number of barriers to farm-school cooperation, such as time and transportation (and to a lesser extent economy), the benefit is significant according to teachers, farmers and students themselves. International studies and practice show that there are many opportunities in teaching about sustainable development,

sustainability and food systems in combination with garden-based and farm-based activities. This is, however, largely neglected in the Danish cases.

Abstract in Danish

I globaliserede fødevaresystemer er forbrugere, især børn, i stigende grad frakoblet en forståelse for, hvordan og hvor deres fødevarer produceres. Dette har en indvirkning på kostvaner og valg, der påvirker sundhed, miljø, landbrug og andre etiske dilemmaer som dyrevelfærd og fair trade. Gårdbesøg og et tættere samarbejde mellem landmænd og lærere gennem skolen kan aktivere børn til at få en direkte forståelse og potentiel interesse i hvordan deres fødevarer produceres, i landbruget og et forhold til landmænd, som en autentisk lærer og ekspert. I mit ph.d.-projekt undersøger jeg forskellige skole-og landbrugs samarbejder og motivation, læringsmål og værdier blandt landmænd og lærere, der arbejder sammen for at fremme børnenes forståelse for mad, natur, landbrug og bæredygtighed. Ph.d. studiet er baseret på fire casestudier og en gennemgang af danske undervisningsmaterialer i relation til fødevarer, landbrug og bæredygtighed. Resultaterne viser, at hvad der motiverer landmænd og lærere til at samarbejde, er evnen til at give elever en tættere tilknytning til natur og landbrug samt en forståelse for og interesse i fødevarer, landbrug og økologi og dermed ideelt set kvalificere deres fremtidige forbrugsvalg. Gårdbesøg og elevernes egne eksperimenter på gården og i klassen skal påvirke deres maddannelse og forståelse for økologi og landbrug. Andre vigtige læringsmål er at bidrage til elevernes sociale færdigheder, dannelse og akademisk forståelse af komplekse teoretiske termer gennem virkelighedsnære aktiviteter. Gårdbesøg er mest effektive, hvis de bliver fulgt op i klasseværelset før og efter og henviste til senere i løbet af grundskolen. Selv om der er en række barrierer for samarbejdet, såsom tid og transport (og i mindre grad økonomi), er fordelene væsentlige iflg. til lærere, landmænd og elever. Internationale studier og praksis viser, at der er mange muligheder i at undervise om bæredygtig udvikling, bæredygtighed og fødevaresystemer kombineret med udeskoleaktiviteter og gårdbesøg. Dette er dog i vid udstrækning forsømt i de danske cases.

Chapter 1 Introduction

This chapter will present the background and motivation of the thesis and a brief overview of the State of the Art, based on which the research aim and questions were developed. Key concepts will then be presented as well as the structure of the thesis.

1.1. Background and motivation

In the globalized food system, adults and children are becoming more and more removed from agriculture, food production and knowing about the process from farm to table. This includes the complexity of how, where and when food is produced and understanding the impact of production, processing, packaging, transport and distribution as well as the consumption choices on the environment, health and farm economy. Loss of cooking skills, increased consumption of highly processed foods and difficulties understanding food labels all pose challenges for public health with increasing obesity rates and other diet related health challenges. Unsustainable patterns in the food production chain and consumption play a significant role in environmental destruction, loss of biodiversity, greenhouse gas emissions affecting climate change, erosion of local farm culture and economy as well as a fair distribution and use of resources.

Schools have long been viewed as a key arena for promoting healthy diets and a sustainable development agenda both within the food system, health promotion and environmental protection. Experiences from e.g. the US and Italy show that collaboration between farms and schools can be an important driver for reshaping the spatial, economic and social relations between producers and consumers. These relations can ideally help push for health, ecological, social and economic benefits within the food system in the shift towards a supply of more quality foods and multi-functional farms that go beyond merely food production to also include educational, leisure, green care and natural resource preservation functions and the development of more sustainable, local food systems (Canavari, Huffaker et al. 2011, Feenstra, Ohmart 2012, Morgan, Sonnino 2008, Hess, Texler 2011).

Promoting an agenda of sustainability within the food system through the school setting is, however, not just about the food supply itself, but just as importantly about educating future generations to be knowledgeable and interested in their food. It is about sparking an interest and providing schoolchildren with the values, knowledge, skills and competencies to make decisions that are sustainable environmentally, economically and socially. It is this ideal, which has been the motivation of this research.

1.2. State-of-the-art: The Scientific Relevance of the Project

The following section will present the initial knowledge base, which was the starting point of this Ph.D. study as well as how key terms such as food literacy, food citizenship and Education for Sustainable Development were initially defined and connected as the rationale for the Ph.D. project. Secondly, an argumentation for the research gap and relevance of this research will be provided.

On the education side, farm-school collaboration in programs and research (sometimes combined with a local food supply) in the US, Canada, UK, Australia, Norway and Italy show several benefits for nutrition, learning and social and personal development and skills in children. The integration of farm-based and/or garden-based learning in the curriculum not only has the potential to increase schoolchildren's food knowledge and agricultural knowledge, studies also show the benefits of especially garden-based education on enhancing academic skills including science skills/aptitude and interest (Skelly, Bradley 2007) as well as social competencies and personal development in students (Skelly, Bradley 2007, Green 2004, Waliczek, Bradley et al. 2001, Horgan 2010). Ecological literacy, connectedness to nature and the community are also benefits, which studies show linkages to in garden-based and farm-based education (Green 2004, Ratcliffe 2007). The majority of studies, however, are programme evaluations or intervention studies, which focus on and document the beneficial impacts on promoting health primarily measured through documenting increases in fruit and vegetable intake amongst participating children and/or willingness to taste new foods (Heim, Bauer et al. 2011, Heim, Stang et al. 2009, Ratcliffe 2007, Ratcliffe, Merrigan et al. 2011, Horgan 2010, Evans, Ranjit et al. 2012, Cullerton, Vidgen et al. 2012, Moss, Smith et al. 2013).

Programs and related research in Australia and Canada focusing on food and nutrition education for youth, e.g. with cooking and/or garden based learning and other activities, are framed as having overall aims of fostering food literacy (Cullerton, Vidgen et al. 2012, Smith 2009). Similar is the trend in Denmark, where food literacy has become a relatively new and trendy term often used as the overall goal in connection with school garden initiatives, school meal interventions and other food and cooking interventions in schools (Wistoft, Otte et al. 2011, Benn 2012). However, there is generally a limited focus on research related to food literacy and clear definition of the term.

Compared to school garden research, research on farm visits and farm-school programs is rather limited as a practice field of children's learning about food, sustainability, environment, science, health and nutrition. Making linkages between food literacy and sustainability in schools is presently primarily an educational field within home economics, where the links between food production, nature, environment, consumption, health and nutrition and global and local issues are tied together. However, other fields of study such as science, biology, social studies and interdisciplinary subjects such as health also overlap with this field, and some schools do have educational programs where these links are made.

In some programs and school practice, notably school gardens, aspects of Education for Sustainable Development[1], food literacy and farm-to-table perspectives are integrated. A review of these programs by FAO and the International Institute of Educational Planning shows that the basis and

[1] Education for Sustainable Development (ESD) is an umbrella of educational activities around the world related to sustainable development based on the idea of implementing programs related to local environmental, economic, and societal conditions that are locally relevant and culturally appropriate. ESD was first described in Chapter 31 of the 1992 UNCED Agenda 21, highlighting the importance of improving basic education, reorienting existing education to address sustainable development, and developing public understanding, awareness, and training

objectives of these programs (which cover important aspects of what could be linked to sustainability) are to:

"Introduce youth to sustainable agriculture and environmental education using the scientific method as a conceptual and hands-on learning process that stresses critical thinking, reasoning and problem-solving. Youth educators thus draw on rich mixture of multidisciplinary topics such as agriculture, natural resources, environmental management, health and human safety, and horticulture. The impact [of various garden- and agriculture-based programmes] have been seen through increased knowledge of scientific methods, plants, fertilizer and pests, as well as positive attitudinal and behavioural changes, increased awareness and facilitation of higher order thinking processes." (Desmond, Grieshop et al. 2004) (p. 40)

In addition to school gardens playing a key role in promoting pro-environmental behaviour, appreciation of nature and eco-literacy, Garden Based Learning (GBL) has been linked closely to health and nutrition promotion primarily obesity prevention. This attention to nutrition promotion is replicated in the research focus within garden- based learning on nutritional impact of school garden programs.

There are few documented lessons learned and evaluations - and even less research - in the area of farm-school collaboration and food literacy in Denmark and Europe at large, e.g. in Norway and Germany. In the Danish context, one example is the Haver til Maver program[2] (Gardens for Bellies) in the municipality of Fredensborg, where more than 10,000 students since 2003 have enrolled in the project and visit the farm Krogerup in Humlebæk eight times over a school year, learning about organic production in school garden plots, preparing meals in an outdoor kitchen and learning about the surrounding nature from a farmer, a chef and a nature guide. This project is a good example of a more holistic and sustainable approach to food literacy and was recently evaluated to document the lessons learned and disseminate the concept to other municipalities (Wistoft, Otte et al. 2011)

There are several practical examples of collaboration between farmers and teachers, most of them short one-time farm visits. Organic Denmark[3] (Økologisk Landsforening, from now on referred to as OD) – an association of organic farmers, businesses and consumers in Denmark – has set up a farm-school initiative, where school visits to farms have been connected to an educational program on ecology, organic foods, food production and cooking skills within the subjects of 'nature/technology' (science) and home economics. The Danish Agriculture & Food Council (Landbrug & Fødevarer, from now on referred to as DAFC), representing the farming and food

[2] The Garden for Bellies program is farm-to-table non-profit programme by the organic internet-based company Aartiderne. This school garden program has been set up to enable children to learn about food, agriculture, cooking and healthy food habits, through growing their own food at the farm and cooking the home-grown food. http://havertilmaver.wordpress.com/haver-til-maver-dk/
[3] Økologisk Landsforening (OD) is an association of organic farmers, businesses and consumers in Denmark

industry of Denmark[4] is involved in similar initiatives across Denmark with more than 650 participating farms.

Internationally there has in other words been a focus on documenting the impact of respectively school garden and farm-school interventions on schoolchildren: on their health and nutrition, academic knowledge and environmental behaviour. However, the perspective of teachers and farmers has largely been overlooked. With the interest in how food and agricultural education can be combined with Education for Sustainable Development and contribute to long-term food citizenship, it was important for this research to focus on the learning goals, underlying values and motivation of the farmers, teachers and other stakeholders in order to understand the content and objectives of what schoolchildren are learning and how. It is about understanding current practice: in terms of learning goals and methods, but also what motivates farmers and teachers engaged in collaboration and to characterize different types of collaboration arrangements. It is likely that the type of collaboration has an impact on the learning goals and methods.

An important question of investigation is how stakeholders involved in the farm-school collaboration view these efforts, i.e. what the motivation, learning goals and values are behind the collaboration. This will inevitably have an impact on the extent to which ideals of developing action competence and sustainability understanding are incorporated into the programs; thus affecting the extent to which farm visits and other farm-school collaboration can influence children's food literacy and future actions. An important question is therefore whether these programs aim at developing food literacy, citizenship, action competence or sustainability thinking, or if they are more isolated efforts aiming at prescriptive approaches and individualistic goals of increasing individual knowledge, learning and behaviour?

1.3. Research aim and questions

With this background and motivation, the following aim, theses and research goals were formulated.

Research aim:

"To contribute to a better understanding of current practice in farm-school collaboration in Denmark and to provide a theoretical perspective on food literacy and food citizenship"

Pre-assumptions:

1. Children lack food literacy: specifically knowledge of where, how and when food is produced
2. Different stakeholders in the farm-to-school context have different interpretations, objectives and values in regards to the farm-school collaboration and food education

[4] Landbrug & Fødevarer (DAFC) represents the farming and food industry of Denmark, including food business-, trade- and farmers' associations

3. There is a lack of links between food literacy, health and sustainability perspectives and limited focus on developing children's related action competence in existing practice in farm-school programs.
4. The scientific and theoretical foundation related to 'food literacy' and 'food citizenship' is weak at present and needs a future orientation linked to Education for Sustainable Development.

Based on these normative theses and potential problems, the following research questions help investigate some of these pre-assumptions and identify possible recommendations for future action and theoretical perspectives.

Research questions:

- What are the overall learning goals, motivation and values behind farm-school collaboration cases and related teaching in Denmark?
- How can the collaboration arrangements be characterised in the various farm-school programs in Denmark?
- How can farm-school collaboration and related teaching contribute to theoretical perspectives on food literacy and food citizenship and integrate Education for Sustainable Development (ESD) perspectives?

1.4. Definitions and delimitation

An important delimitation of the research is that it will not document what students learn as a result of their farm visit. The focus is on long-term and less concrete factors such as broader citizen-based food literacy or food bildung (referring to the German roots of the Danish term *maddannelse* or *dannelse*) and action competence. The assumption is that the experiences, including farm visits and longer collaboration, can provide students with insights and experiences, which in addition to short-term academic learning and broader understanding, can give students concrete experiences and insights, which they can draw on later in their education and in life. For these reasons, the focus is rather on the intentions, i.e. primarily what the learning goals are of the teachers and farmers, the content of the teaching, how the teaching and learning process is organized including what methods are used from a didactic perspective. In addition, various external factors related to e.g. funding, transport, political support, support from interest organisations and educational materials will be investigated. The main focus of the farm-school collaboration investigated in this Ph.D. project is on kindergarten to 10th grades.

The theoretical concepts used will be briefly defined here and further elaborated and developed in the following chapters.

Food literacy

With limited definitions of food literacy, the starting point of looking at and further developing the term food literacy will be based on an understanding of food literacy as being a relative ability to understand the nature of food and your own impact as a consumer and citizen on health status, environment, social and economic factors. Food literacy will be further defined in chapters 6 and 7.

Food bildung

This term originates from the Danish term *Maddannelse*, which has its roots in the German educational tradition, where the term *Bildung* originates. It is a broader terms than food literacy in the sense that food bildung can refer to broader life skills, self-development and citizenship through food and farm collaboration than what is the case with the more hands-on and academic skills inherent in the term food literacy. The term 'bildung' has according to one school of thought to do with democratic citizenship rather than compliance and individual behaviour. It is about forming ways that stimulate and qualify students to become future citizens, who can make sound judgements, think critically and independently, and who can and will play an active role in society. (Mogensen, Schnack 2010) This understanding of food bildung is connected to the term 'food citizenship.' However, bildung can also have a more individualised focus in terms of self-development, which according to Hammershøj is a more individualized process. In contrast to earlier times' fixed ideals about what an 'educated' person was, in Hammershøj's post-modern perspective it is a process and ideal, which is negotiable and defined by the individual. (Hammershøj 2003) It is based on his/her own likes and dislikes. Both democratic/citizens-oriented bildung and individualised bildung or self-development can be mediated and developed through food. Although the focus is different, the one does not necessarily exclude the other.

Food citizenship

This is closely linked to the citizenship perspective of food literacy and bildung and relates to the definition by Wilkins, on food citizenship being about:

"Engag[ing][citizens or students] in food-related behaviours that support rather than threaten, the development of a democratic, socially and economically just, and environmentally sustainable food system" (Wilkins 2005) p. 269.

Education for Sustainable Development (ESD)

In short ESD has an overall ideal, which is to develop the students' ability, motivation and desire to play an active role in finding democratic solutions to problems and issues connected to sustainable development (Mogensen, Schnack 2010).

It comprises an umbrella of programs and educational principles including future visions, critical thinking, working with conflicts of interest and empathy for current and future generations. It targets integration into all levels and areas of education and life-long learning initiatives, including primary education.

Sustainability and sustainable development

Linked to ESD are the underlying concepts of sustainable development and sustainability. Sustainable development has been defined by UN's World Commission on Environment and Development (WCED) as:

"*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987)(Chapter 2).*

Without going into great details, sustainable development includes an environmental, social and economic dimension and is about reconciling economic activity, social progress and environmental protection. It is about promoting equity between present and future generations, promoting empathy, responsibility and having a global perspective locally. The term sustainability is about appropriate resource use within the ecological 'carrying capacity' of the planet and a reduction in the intensity of resource use. Recognizing the biophysical limits to growth, the sustainability and sustainable development agenda promotes a shift in production and consumption to a less resource intensive one.

Farm-to-school programs

Farm-to-school is a broad definition for school-based programs that connect schools and local farms with the objectives of serving local and healthy foods in school cafeterias or classrooms, improving student nutrition, providing health and nutrition education opportunities, and supporting small and medium-sized local and regional farmers. (Joshi, Azuma et al. 2008) In practice, most farm-to-school programs only incorporate some and not necessarily all of these components. School gardens and related educational activities are included under the umbrella of farm-to-school programs.

Although many farm-to-school programs incorporate a classroom component, the programs in the US have emerged from the alternative agriculture movement as a strategy for developing new markets for local, sustainably-grown food rather than a mechanism for educational reform (Kloppenburg, Wubben et al. 2007).

Most research and practice on farm-to-school collaboration and programs reflect this marketing emphasis and mostly concentrate on the demand for connecting farms with food services. The rationale for programs that engage students in additional educational activities such as tasting sessions, farmers and chefs in the classroom or farm visits is to increase children's knowledge about their food and its production and students' desire to consume diverse fresh fruits and vegetables in the cafeteria.

The focus of the farm-school collaboration in Denmark and in this dissertation is on farm-school collaboration with an educational dimension. Since Denmark does not have a strong tradition for

school meals but rather of packed lunches, the collaboration between farms and schools does not have the food provision focus as it does in e.g. the US, Brazil and Italy.

Farm-school collaboration

Although related to farm-to-school programs, for the purpose of this dissertation, the concept of farm-school collaboration is used and defined as different models of collaboration between farmers, teachers and others related to educational dimensions of food, agriculture, environment and other topics. This includes field visits to farms, farm-stays, school gardening on farms and other types of collaboration with farmers.

Food and agriculture education

When referring to food and agricultural education it includes all aspects of educational content, including learning goals, educational materials and methods used, which relate to food and agricultural topics. Farm visits and other related activities are part of this, which includes agricultural content and educational methods. However, food and agricultural education goes beyond the content of the farm visit and related activities to also include the pre- and post-farm visit curriculum.

1.5. Structure of the dissertation

The background and theoretical point of departure for this dissertation has been presented earlier in this chapter. This has provided a theoretical framework for this thesis, which will be further elaborated in the ***Chapter 2*** on Methodology and Research Methods. Here the case study design and analysis strategy will be presented to help explain the methodology of this thesis.

Chapter 3 is a more in depth review of existing research in the area of farm- and garden based learning, farm-to-school programs and outdoor education. These are all research areas, which overlap with the theme of this research project. It will provide an overview of existing research and the main findings, including challenges and impacts documented so far. It will also highlight where the gaps exist in current research. This will pave the way for an understanding of where this dissertation will contribute with new knowledge related to food literacy and farm-school collaboration and learning.

With the gap in existing research in mind, ***Chapter 4*** will present the empirical findings of existing farm-school collaboration and food and agricultural education in the Danish case studies. This includes an analysis of the findings related to collaboration arrangements and models, the main drivers in this field as well as the identified motivation by the main stakeholders and various challenges and opportunities expressed by the teachers, farmers and farmers' interest organizations. The findings related to challenges and opportunities will be used to identify recommendations for farm-school collaboration and food and agriculture education in chapter 8.

The empirical findings will be further analysed in ***Chapter 5***, where learning goals and values of the different stakeholders will be presented. This will be based on interviews and analysis of educational materials. The analysis of learning goals and values will be linked to how the stakeholders integrate these goals with concrete activities in the classroom and on-farm. Based on these analyses, the chapter will tie in the current practice in the four cases with an analysis of if and how broader aims related to food literacy, food citizenship and Education for Sustainable Development are applied in practice.

The findings from the empirical analysis in chapters 4 and 5 will inspire a more in depth analysis and new angles on the theoretical concepts of food literacy, food citizenship and Education for Sustainable Development and their interrelations. In ***Chapter 6***, the concepts from the theoretical framework presented in chapter 1 and 2 will be further elaborated, inspired by the some of the findings from the two empirical chapters. The concept of agricultural literacy will for instance be analysed and connected to food literacy and food citizenship. The overall umbrella of Education for Sustainable Development and its educational principles, including action competence, will be further elaborated and linked to the more specific goals of food literacy and agricultural literacy.

Chapter 7 will discuss and merge the key empirical and theoretical findings related to food literacy, food citizenship, ESD and other core concepts into a new and future oriented theoretical contribution on food literacy and food citizenship. Perspectives on how farm-school collaboration and food and agriculture education as learning spaces and processes can contribute to food literacy and food citizenship will be discussed.

The dissertation will conclude with ***Chapter 8***, where the theoretical contribution from chapter 7 will be used to inspire a proposal for a curriculum for food and sustainability education. Recommendations on future directions related to stakeholder collaboration will also be provided.

Chapter 2 Methodology and research design

The Ph.D. study takes its point of departure in a normative approach; aiming to contribute theoretically to the understanding of the concepts food literacy and food citizenship while gaining an understanding of current practice in farm-school collaboration and how this can be strengthened to contribute to children's food literacy and citizenship. This is connected to the overall research objective of this Ph.D. project:

"To contribute to an understanding of current practice in farm-school collaboration in Denmark and to contribute with theoretical perspectives on food literacy and food citizenship"

Based on four exemplary cases, existing practice will be described and analysed focusing on learning goals, values and overall motivation from the theoretical perspective of food literacy, food citizenship and Education for Sustainable Development (ESD).

Normative research aims at identifying improvements, even from an ideological point of view. It can both be descriptive in terms of evaluating the present state of things, identifying problems but also providing recommendations for future solutions. (Coch 2004) Through a description and analysis of current practice and research, principles and its practical application related to food literacy, food citizenship and ESD will be identified in the context of food and agriculture education. A theoretical/conceptual contribution and recommendations will be made to food and agriculture education with action competence, citizenship and ESD angles, which are currently lacking.

An abductive approach (also referred to as adaptive theory) will be applied, which is when current theory (and ideals related to food literacy, food citizenship and ESD) inspire the analysis of the cases and the cases inspire and contribute to theoretical reflections and further development in regards to the field:

"*The research becomes a dialogue between data and theory mediated by the researcher*" (Blaikie 2009) (p. 156)

The abductive research approach will be further elaborated in the following sections and is linked to the philosophy of science point of departure presented below.

2.1. Philosophy of Science approach

The abductive research approach of this study is linked to hermeneutic phenomenology and an interpretivist approach, which means that there is not one reality but more that can be more or less informed (Denzin, Lincoln 2000). With a hermeneutic phenomenological approach of understanding the field and life worlds and the human experience of the participants in the cases, the aim of the research has been to analyse the significance and meaning of the stakeholders related to the farm visits, teaching and their collaboration focusing on an analysis of their motivation,

learning goals and values but with a theoretical framework to guide the data collection and analysis. The analytical approach and strategy will be further elaborated in section 2.6

Epistemologically, my values as a researcher and role have been central in the research, acknowledging that this is essential as well as the interactions between the researcher and the investigated in creating the findings (Laverty 2008). From the initial stages of the research, my normative objectives and assumptions were written down and reflected over in a research journal, in order to make my presuppositions and assumptions clear (see section 2.3.2.). In Heidegger's work inspiring hermeneutic phenomenology, the importance of one's past experiences, or 'historicality' as Heidegger termed it, are important to become as aware as possible of in order to be able to reflect on how this influences one's interpretation of the data. Also the historicality of the participants e.g. teachers and farmers will be important in the interpretation of the data. Although it is important in qualitative research and within hermeneutic phenomenology to be aware and explicit about one's own assumptions and historicality, I as a researcher cannot be completely objective or value free according to Gadamer (Gadamer 1976). Thus there is an acknowledgment that the study is influenced by my own values, which have guided the selection of theory and analytical framework, influencing the understanding of stakeholders' values, motivation and learning goals from this point of departure.

The research is shaped by normative theories and goals, such as food literacy, food citizenship and Education for Sustainable Development (ESD), which I as a researcher have an interest in and background working with. With a background working with and teaching issues of sustainable development, food, agriculture and environmental issues, my interests and assumptions related to these topics influence the direction of the research and also the interpretation thereof. Giving thought to this and explicitly claiming ways in which this position relates to the issues researched is important in hermeneutic phenomenology. It is in other words the food literacy, food citizenship and ESD perspectives, which underline a great part of the research and analysis of empirical data. At the same time, an openness to include other themes and categories expressed by farmers and teachers about food education, the farm visits and cooperation will be applied. My initial research objectives of looking at farm-school collaboration and related education from a food literacy, citizenship and sustainability perspective will in other words be expanded to also look at themes such as the collaboration and education from a broader perspective influenced by the interviewees and other data.

Methodologically, this process in interpretivist research and hermeneutic phenomenology can be described as a process of interpretation and interaction between the researcher and the research participants. This is linked to the abductive approach of the research with its interaction between theory and data. In addition, understanding the field of farm-school collaboration has been done through the interchange between understanding the different parts (e.g. the different stakeholders' experiences, overall learning goals and motivation in the different cases and the overall learning goals behind the educational materials) to understand the whole field and vice versa: in other words, the principle in hermeneutics called the hermeneutic circle. This is done by going back and forth

between looking at parts (quotes and exercises carried out) to understand the whole meaning, i.e. the underlying learning goals, motivation and is especially relevant for understanding underlying values. The process includes self-reflections, whereby reflections are written down throughout the process and used later in both data collection and final analysis of data. Keeping reflective journals (or log books) is one way of going about the hermeneutic circle in order to be explicit about one's pre-understanding or assumptions and realizations.

As mentioned, the research takes on an interpretive and a normative approach but also a descriptive. The descriptive approach will be applied when analysing current practice, collaboration arrangements and opportunities and barriers related to farm-school collaboration. The overall approach will be interpretive and normative in terms of interpreting interviews and written documents and reflecting on and interpreting the normative ideals related to food literacy, food citizenship and Education for Sustainable Development on which to look at food and agriculture education and its future potential. These are in other words the theoretical foundation and educational ideals for looking at current practice: the goal being to assess how and if the stakeholders work with these overall educational goals and principles in mind, which are important for ensuring that future citizens are responsible and concerned about food, agriculture and the environment. At the same time consideration for the interviewees' historicality or background is taken into consideration.

These theoretical terms take on a transformative and normative point of departure when looking at education; with goals of preparing children to understand and respect nature and food, as well as to engage in change towards a more sustainable society and future, specifically in relation to the food system. The subject area will also contribute to the so far limited theoretical understanding and definition of food literacy and food citizenship. This will be done by describing and qualifying concepts of food literacy and food citizenship through a review of existing theoretical perspectives and combined with empirical findings, i.e. how various stakeholders understand and work with and towards food literacy and food citizenship as overall objectives. Further, the ideals related to food literacy, food citizenship, action competence and ESD are operationalized and will be used to develop recommendations for future farm-school collaboration with these overall educational ideals in mind.

The hermeneutic phenomenological research approach is also reflected in the selection of interviewees, as they are all participants, who have experience with farm visits and were likely to be highly engaged and positive about these visits. Their willingness to talk about their experiences and thoughts (learning goals, values and motivation) is essential to the research project. The selection process has also had the aim of selecting interviewees and programs that are diverse enough to increase the possibilities of getting as rich and unique stories of the particular experiences as possible, which according to Laverty (2003) are also essential characteristics of hermeneutic phenomenology.(Laverty 2008)

2.2. Research methodology

In the following sections, the overall research methodology will be presented including the literature search strategy and the case study methodology.

2.2.1. Abductive research methodology

The abductive research approach was organized in a number of phases to ensure an interplay between theory and empirical data. Figure 1 is inspired by Kovács and Spens (2005) abductive research process model (Kovács, Spens 2005) and illustrates all the components of my research process. In addition to prior theoretical knowledge and the time spent understanding what has been written theoretically (step 0 in the research process in figure 2) (later identified as food literacy in English) related to food bildung, food citizenship, action competence and Education for Sustainable Development (ESD), I developed a theoretical framework/matrix to operationalize the different components and theoretical principles – the step (1) in figure 1. This theoretical framework is made to break down these key concepts into more concrete terms and principles, which could more easily be used when developing interview guides and guidelines for assessing written documents (presented in section 2.5.).

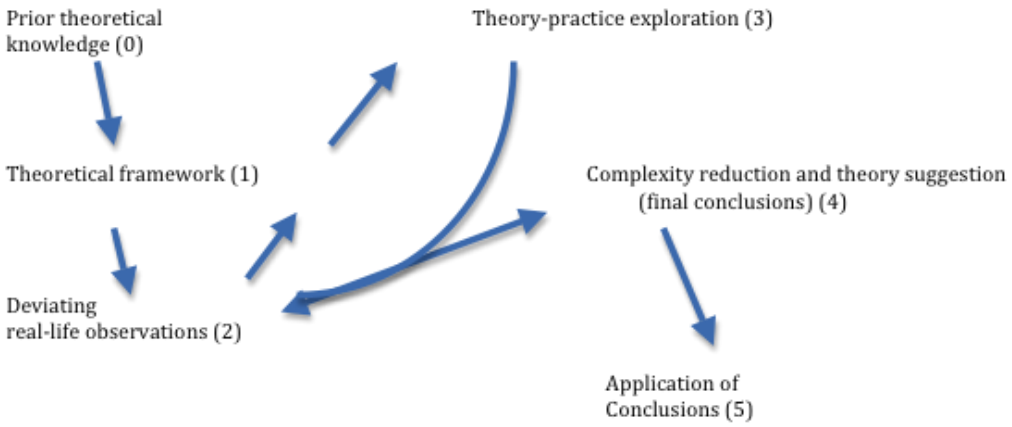

Figure 1: Abductive research process in the Ph.D. project (inspired by Kovács and Spens, 2005)

During the empirical data collection process, observations of the field and understandings of the interviewees related to these key concepts and real life practice are documented (step 2). Subsequently a longer process of exploring the theory in relation to the empirical findings and vice versa is conducted (step 3). The empirical perspectives related to the theory are presented in chapters 4 and 5. This ping-pong process between theory and empirical understanding is illustrated with the arrows between steps 2 and 3 in figure 1. Step 4 aims to reduce complexity between the theoretical framework and practice and to make theory suggestions. Informed by a revised theoretical overview, presented in chapter 6, the theory suggestions will be presented in chapter 7, where I will present my own theoretical perspectives on food literacy and food citizenship informed

by the empirical findings. Finally, in step 5 these theoretical discussions, recommendations, conclusions and assessment of practice will form the basis of the final chapter 8.

The process of categorizing and analysing empirical findings and further elaborating on the links between theory and practice using NVivo 10 qualitative analysis software will be further elaborated in sections 2.6 of this chapter.

2.2.2. Literature search strategy and methods

The following section outlines the search strategy applied for the literature review and methods used. It considers the selection criteria for including/excluding material, the search methods used to identify relevant research and the review processes.

Search parameters

The scope of this review was determined by a series of search parameters designed to get an overview of international research relating to:

1. *Types of research* in the area of farm-school collaboration, food education and food literacy related areas such as school garden, garden-based learning, outdoor learning and Education for Sustainable Development. It was further elaborated by research on agricultural literacy later on in the research process inspired by findings from the empirical work done in Denmark.
2. Research documenting evidence related to *impacts* of farm-based, garden-based and/or food and nutrition education and outdoor education.
3. Research identifying *challenges and opportunities* in farm-based, garden-based and/or food education, food literacy, agricultural literacy practice and outdoor education, including recommendations and theoretical perspectives and frameworks within these fields.
4. *Conceptual* papers on respectively food literacy, food citizenship, agricultural literacy and ESD.

Search methods

Scientific articles were found through searches in PubMed, Google Scholar and ERIC databases using the following search terms:

- Food AND literacy, farm/agriculture AND literacy, farm AND school

Only studies in English language were selected. ERIC was found to be the most useful database, as it is the largest education database in the world. It indexes over 725 periodicals and currently contains more than 7,000,000 records. Coverage includes research documents, journal articles, technical reports, program descriptions and evaluations and curricula material.

This brought 17 studies of which 7 were relevant and dealing with primary schools and primary schoolchildren.

Additional searches on PubMed, ERIC, Google Scholar (and the internet in general) were also done to broaden the search and get access to more related data.

The following additional search terms were used:

- School gardens,
- Garden-based education,
- Outdoor education, outdoor learning
- Eco-literacy, ecological and agricultural literacy
- Education for Sustainable Development, sustainability education

Additional scientific articles related to the themes mentioned above were found through the references in the various articles reviewed, thus ensuring a snowball effect in the literature review.

Studies were included that were published primarily between 2003 and 2013, reflecting a desire to examine the most recent research findings. However, other relevant studies were found as important references in some scientific articles, some of which were older than 2003, but were included due to their relevance.

The searches were further narrowed down to only studies focusing on schools (primary and lower primary education) excluding secondary schools and above. Due to limited research in Denmark and in general especially related to food literacy and farm-school collaboration, grey literature such as few Masters theses, non-peer-reviewed articles/reports and conference abstracts as well as books were included to some extent as well as research focusing on secondary school students. This was primarily the case due to the very limited work done in Denmark, for which reason additional studies including non-peer-reviewed articles were included from Denmark as well as Norway.

Geographically, studies were selected primarily from the USA, where the majority of research is taking place (and available in English language). Other research articles were included from Canada, Australia, United Kingdom, Ireland and Germany. An overview of the search parameters is provided in table 1.

Table 1: Search parameters overview

Overall Focus	Empirical research and conceptual research on food literacy, food education, farm-school programs, and agricultural literacy. Additional research on school gardens and outdoor education was included as well.
Timescale	Primarily work published between 2003-2013 but expanded to also include earlier work
Age range	Kindergarten to 10th grade primarily
Geographical scope	International (primarily articles published in English), however, articles/reports published in Danish were also included.
Sources	Primarily peer-reviewed publish articles and research reports,

	However, due to limited research on farm-based education, and research from Denmark in related fields, abstracts from conferences (on practice and research in e.g. Norway), reports, Master thesis, Government documents, educational materials and websites were also included.

The literature was reviewed based on the following parameters:

- *Target group and location* focusing on primary schools both primary students AND teachers teaching primary school;
- *Study design/methodology* – aiming at being able to both characterize the different research from a methodological perspective while also getting a variety in terms of different methodological approaches to the field. Both quantitative, qualitative and mixed method studies were selected.
- *Results and conclusions* – was used to get an overview of the documentation of impacts on schoolchildren but also of broader issues related to teachers' prerequisite and experiences as well as more conceptual views and research processes related to food and agricultural literacy.

The literature review is presented in a matrix in Appendix 1. A summary table of the peer-reviewed literature is in the table 2.

Table 2: Review of research (peer reviewed research)

Topics	Number	Countries
School gardens/garden based learning	15	USA, Canada, Australia, Germany, Ireland, Denmark, International
Food literacy/food Education/food skills	11	Australia, USA, Canada, Germany, UK, international, conceptual
Agricultural literacy	12	USA
Farm-to-school/farm-based learning	13	USA, Canada, Europe, Italy
Education for Sustainable Dev.	3	USA, Canada, international
Outdoor learning Outdoor education	6	Denmark, UK, Australia, international
Total	**60**	

2.2.3 Case study methodology

In order to shed light on the current practice within farm-school collaboration a ***multiple case study approach*** was selected relying on qualitative data. Although the case study approach is not always recognized as a proper scientific method, due to arguments of it being too situation specific, subject to the researcher's subjective analysis and having limited basis for scientific generalization, there are many benefits of learning from particular cases. Flyvbjerg (2004) argues that these misconceptions about case study research are misleading: case study research can produce important context-dependent knowledge, which according to him, is just as valuable as other methods for testing universal and predictive theories. Flyvbjerg explains that for generating theory and testing hypothesis (including generalizability), the selecting of extreme/deviant or maximum variation cases as in this Ph.D. study can reveal more information about various circumstances and outcomes. (Flyvbjerg 2004) Although the main aim of the study is not to reach scientific generalization, it is possible according to Flyvbjerg to generalize from single or multiple case studies. The in-depth understanding of farm-school collaboration from selecting four maximum variation cases can help get a general understanding of farm-school collaboration in Denmark.

According to Yin, the benefit of case studies is to get an in-depth understanding of a phenomenon through the investigating of different factors influencing the phenomenon. (Yin 2009) Understanding various practices, collaboration arrangements, barriers and opportunities in farm-school collaboration as well as the motivation and learning goals of the stakeholders are best investigated through a case study approach, as it enables an in-depth study of these connections and how the phenomena of investigation are affected by different factors related to the situational context: including geographical factors, personal factors of the teachers and farmers, institutional factors as well as political and other structural factors. Investigating these complex real life phenomena and contexts require, according to Yin, the use of multiple sources of evidence in order to be able to triangulate the various sources of data, although this also poses the challenge of extensive amounts of data. In case study research different types of methods can be used, including more quantitative methods like surveys (Yin 2009). This study uses a mix of semi-structured interviews, field observations and written documents including an analysis of educational materials, student projects and film used as educational materials. Due to this rich amount of data, survey data other than existing surveys by the Danish Agriculture and Food Council have not been collected. Another important feature or definition of case studies is the prior development of a theoretical framework to guide the data collection and analysis (Yin 2009), which was also initially developed for this study, as already described.

Four ***maximum variation cases of*** farm-school collaboration in Denmark were selected reflecting various typologies of farms and farm-school collaboration. This was carried out through the use of multiple sources of evidence: including review of existing research, analysis of teaching materials and learning plans, interviews with farmers, teachers and experts on didactics and educational materials from agricultural organizations, observations of farm visits by schools and students' projects. Case schools and farms in Denmark were selected, where activities in the area of food and agriculture education and farm-to-school collaboration are already carried out.

Selection criteria

The following selection criteria for the cases were:

1. Selection of exemplary case farms: part-time farms, full-time farms, farms with integrated production and specialized production, cooperative farms, conventional and organic farms.
2. Schools that have integrated farm visits into a longer educational program related to food production, consumption, sustainability, health and environment, science etc. in one or more subjects or as interdisciplinary projects.
3. Schools that have established a long-term collaboration with local producers and/or have integrated field trips to the farms with other activities at the schools such as the school food service or the school's values or school policy.
4. To get different perpspectives on how agriculture and food themes and farm visits are used and integrated in the teaching, teachers were selected for interviews from all ranges of grades; from 3rd through to 9th [i] grades. Teachers from both rural and urban, public and private schools were interviewed.

The empirical phase included an initial and follow-up interviews with key informants e.g. in interest organizations for an overview of farm-to-school collaboration and later on feedback and external validation of findings. Case farms were selected with assistance from either the Organic Schoolyard program or the Danish Agriculture and Food Council in terms of providing contact information of farmers and suggesting farm-school cases that met the criteria mentioned above. Through the contact with farmers and on farm visits, teachers were approached that either were on farm visits or had been on one for an interviews and additional observations on-farm or later in the classroom depending on whether or not this was possible, e.g. if their activities had been completed or continued.

Although the aim was to identify teachers that are motivated and were working to integrate farm visits more thoroughly into their teaching as well as teachers that are less motivated and not working extensively with farm visits afterwards, it was difficult to get an interview with less motivated teachers. A few teachers were identified, but were not very willing to be interviewed or only had limited information to share.

2.3. Case study research design

The case study process was organized through the process described in figure 2, which has been adapted to Yin's model (Yin 2009). The figure illustrates how an initial theoretical or analytical framework was developed in order to focus and guide the data collection process especially the qualitative interviews (including the interview guide) but also in terms of analysing educational materials. Secondly, cases were identified based on the aforementioned criteria. Cases were studied simultaneously during 2011 and 2012.

At the outset of the research, a case study protocol was developed and used to guide the research process and structure the design of the research from the practical matters to the case study method and process illustrated in figure 2. The protocol was revised during the research process to reflect changes along the way, e.g. the selection of case study sites. Originally cases from Italy or Germany were planned but it was decided to focus on the Danish cases due to the wealth of cases already present in Denmark. Logbooks were written along the way with reflections from interviews, field observations, literature review, conferences and other sources of inspiration. After completion of the data collection a case study report was written for each case. In the data analysis and writing process, cross-case findings were analysed and conclusions were made (presented in chapters 4 and 5). This was used to inspire a revision and elaboration of the theory discussed and presented in chapters 6 and 7. In practice, however, the last three steps of the research were merged in the writing process.

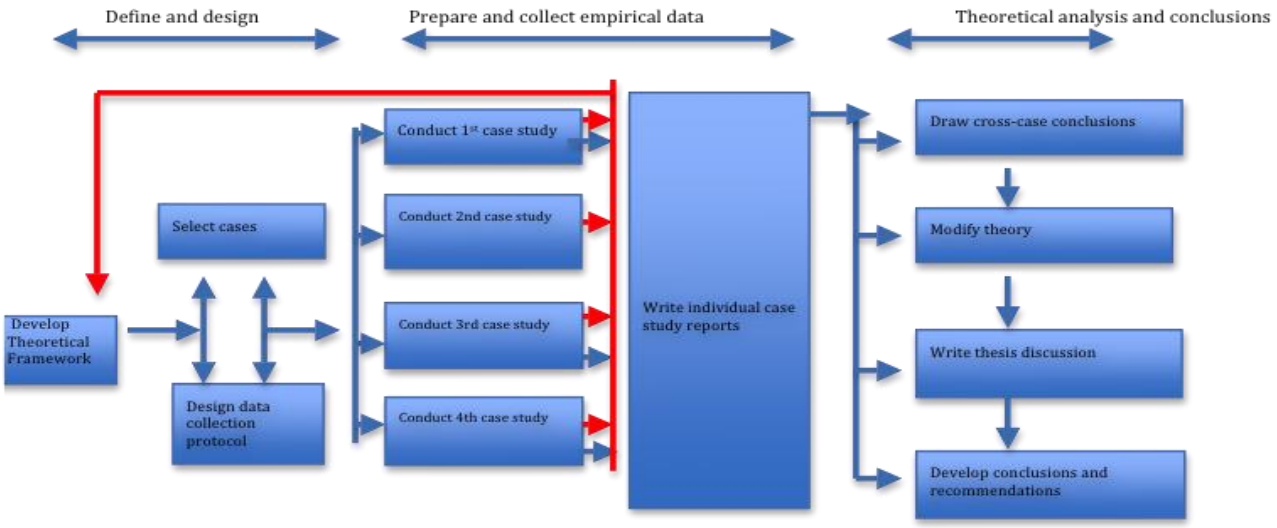

Figure 2: The case study research process (adapted from Yin, 2009)

2.3.1. Case study questions, hypothesis and propositions

In the following section a of the assumptions and research questions presented in chapter 1 are reintroduced and linked to list of working questions to inform the hermeneutic phenomenological approach of the study and help guide the case studies in order to answer the research questions.

Pre-assumptions:

1. Children lack food literacy: specifically knowledge of where, how and when food is produced
2. Different stakeholders in the farm-to-school context have different interpretations, objectives and values in regards to the farm-school collaboration and food and agriculture education
3. There is a lack of links between food literacy, health and sustainability perspectives and limited focus on developing children's related action competence in existing practice in farm-school programs.
4. The scientific and theoretical foundation related to 'food literacy' and 'food citizenship' is weak at present and needs a future orientation linked to action competence and Education for Sustainable Development.

Based on these normative assumptions, the following research questions helped inform the assumptions and identify possible recommendations for future actions and theoretical perspectives.

Research questions:

- What are the overall learning goals, motivation and values behind farm-school collaboration cases and related teaching in Denmark?
- How can the collaboration arrangements be characterised in the various farm-school programs in Denmark?
- How can farm-school collaboration and related teaching contribute to theoretical perspectives on food literacy and food citizenship and integrate Education for Sustainable Development (ESD) perspectives?

To answer these broader research questions, a number of working questions were formulated to help guide the data collection process, including the questions asked during the semi-structured interviews with farmers, teachers and representatives from agricultural interest organizations.

Working questions:

1. How are farm visits in the Danish case farms linked to food and agricultural education in schools?
2. Are there links between food literacy, food citizenship and ESD in existing farm-school collaboration in Denmark and related food and agriculture education in the case schools?

Methods:

- Interviews with teachers about their teaching (including open-ended questions on the content and learning goals and specific questions related to food literacy, health, action

competence and sustainability) and their integration of the farm visit in their teaching back at the school,

- Interviews with farmers about on-farm activities and their understanding of the concept of sustainability and the extent to which they include this term in the activities on-farm,
- Observations on-farm
- Review and analysis of scientific research, learning plans, and educational manuals/materials

Working questions:

3. Who are the main stakeholders and related networks behind farm-school collaboration in the different settings and how are they organized?
4. What are the main challenges and opportunities for farm-school collaboration and food and agriculture education?

Methods:

- Interviews with farmers, teachers as well as representatives from agricultural interest organizations, who provide the support, incentives and other structural conditions for farm visits, were conducted.
- A review of educational goals and school reform by the Ministry of Children and Education and the Danish Government was carried out. All of these factors have an important impact on the collaboration arrangements as well as the barriers and opportunities for farm-school collaboration in the future.

Working question:

5. Are the farm-school activities linked to or aiming at influencing the whole school (e.g. school food supply, school food/nutrition policy and cooking activities)?

Methods:

- Review of school websites and interviews with teachers regarding additional measures and linkages to other part of school practice beyond their own subjects to also include supporting measures in the school and the integration to other subjects and grade levels.

2.4. Theoretical framework on food literacy, food citizenship and ESD

Below is the initial overview of the theoretical concepts on which the analytical framework of the study has been developed. Towards the end, the theoretical framework and concepts are operationalised and put into a matrix, which was used for the development of interview guides and inspired the later analysis of findings and the theoretical overview and further development in chapters 5, 6 and 7.

The term 'food literacy' is not a well-defined term. One exception is a study in by Vidgen and Gallegos (2011) from the Queensland University of Technology in Australia, where it is defined as:

"The relative ability to basically understand the nature of food and how it is important to you and how able you are to gain information about food, process it, analyse it and act upon it" (Vidgen, Gallegos 2011).

This definition is very much focusing on the individual level, in other words the food literacy of an individual and related behaviour. The more used term in Danish is 'food bildung' (*maddannelse*) as an educational goal, and stems from the German term *'bildung,'*

The closest term in English is *'life skills.'* In some contexts, this term is closely connected to food literacy with its focus on the individual and with an underlying consumer focus. This understanding takes on a relatively narrow meaning focusing on learning and development of knowledge and skills related to cooking, health, nutrition, hygiene and sensory aspects of food. It is linked to the former definition of food literacy by Vidgen and Gallegos (2011).

A definition of food bildung from Denmark is by Carlsen, a home economist. Carlsens definition is broader than the one by Vidgen and Gallegos. She sees food bildung as:

- *Self-determination* in terms of pleasure and responsibility concerning one's own body and skills and techniques to produce food;
- *Participation* in aesthetically observing and forming food and making judgment about food choices. The relation to food here moves from the subjective and individual level of self-determination to an interpersonal level, where participation or co-determination is made in connection and collaboration with others and in relation to food choice can take on a critical perspective towards society. These aesthetic choices can in other words include a political choice and not just one of aesthetics.
- *Solidarity* is even more so than the former about interpersonal relations and how our choices are influenced by interpersonal factors as well as making ethical and political decisions and related actions. (Carlsen 2011)

Carlsen's more specific views on what food bildung entails in terms of content related aspects (especially connected to home economics) include such factors as:

- knowledge and skills relevant for health and quality of life, including nutrition, chemical and physical properties of food, cultural and historical factors, hygiene, societal conditions for food and meals, cooking skills and other techniques related to food;
- knowledge on identity related to food including social dimensions and symbolic factors related to food;
- communication, insight and skills related to aesthetic factors and ability to act as a consumer;

- insight into production, its consequences and the impact of consumption, including an understanding of possibilities for change.

Carlsen's view of food bildung is not only about cooking and other food related hands-on skills, but equally about the ability to make choices related to food, health, animal welfare, resources and production conditions as well as about food as a social factor and a source of pleasure. (Carlsen 2011) Carlsen's food bildung perspective is inspired by Klafki, a German thinker and researcher in theory of education and didactics and his work on critical-constructive didaktics (Klafki 2001).

Carlsson and Benn (2010) bring forth a slightly similar definition of food bildung or food literacy, when they talk of competence within the food area as having four dimensions within a learning process:

- *To know:* for instance to know that there is a connection between what you do and the result or impact, e.g. between what you eat and resource use and the environment, or between what you eat and drink and your health.
- *To be able to*: to master everyday life with the resources available, e.g. to be able to make a healthy meal.
- *To want:* is about wanting to participate in working with everyday problems and issues, such as food, production, and make food choices and opt not to eat certain foods, engage in school food policy or in school environmental policy.
- *To be:* includes interaction with and being caring towards others e.g. when choosing and deciding which foods and meals to select that can be eaten by everyone.

(Carlsson, Benn 2010) p. 64 and 69

The emphasis here is slightly less on the food skills, techniques and communication, which Carlsen highlights.

The term 'bildung,' however, has a broader definition that the individual focus; it is tied to democratic citizenship. Bildung is here not so much about compliance and individual behaviour or self-development. Rather it is about forming ways that stimulate and qualify students to become future citizens, who can make sound judgements, think critically and independently, and who can and will play an active role.(Mogensen, Schnack 2010) This understanding of food bildung is more closely related to the term 'food citizenship' which is about engaging students (and other citizens) in food-related behaviours that support rather than threaten, the development of a democratic, socially and economically just and environmentally sustainable food system both in the short and in the long term (Wilkins 2005).

Combining food literacy and food citizenship with sustainability is tied to how our food is produced, understanding the natural foundation of food production, agricultural practice, socio-economic factors influencing our food supply and access and the impact of our food choices on

health, social and economic issues and the environment as well as understanding and *acting* on global and local food issues.

Developing food citizenship is linked to the term 'action competence', which is an educational approach and ideal that challenges individualistic approaches and the emphasis on behavioural modification within health and environmental education. Action competence within education research has been defined by Elmose (2007) as 'knowledge', 'action experiences', 'involvement' and 'co-determination' (Elmose 2007). Jensen stresses the key importance of *commitment* in relation to action competence. Knowledge alone – including knowing how to act - will not necessarily lead to any actions – thus making the combination of commitment, experience and knowledge key. Commitment is often strengthened or spurred through a sense of community – for which reason the focus on the individual level has been largely ineffective (Jensen 1993). The focus on knowledge transfer and modifying individual behaviour alone in health promotion and environmental education has been documented to be ineffective and often lead to feelings of guilt and apathy (Breiting, Schnack 2009, Breiting, Hedegaard et al. 2009). As a result, there has been a shift towards emphasizing the development of action competence; focusing on positive visions and concrete actions to ultimately develop responsible and action-minded citizens capable of seeing "beyond their own noses", and trusting that they can have influence. (Breiting, Hedegaard et al. 2009) In doing this, one key role for Education for Sustainable Development (ESD) in an action competence perspective is according to Mogensen and Schnack (2010) about developing students' ability, motivation and desire to play an active role in democratic solutions to sustainable development (Mogensen, Schnack 2010). Food citizenship and Education for Sustainable development (ESD) overlap: thus both have to do with democratic citizenship rather than compliance and individual behaviour.

Building closer links in the food system through the establishment of collaboration between local farmers, schools and students to promote sustainable and healthy food behaviours and actions can provide an important practice field for students to enhance their learning and food literacy - and ideally build food citizenship. An important lesson from education research and reviews of school food experiences is the important link between learning and experience. According to Dewey, learning is fostered and enhanced through the individual's own actions, thoughts and experimentation in practice and in the surrounding society (Vaage 2000), which farm visits and related teaching can be an example of. Action-oriented learning can enable student ownership and develop important action competence (Jensen, Simovska et al. 2005). Establishing collaboration between the school and local farmers, facilitating farm visits and students' own actions at school or in the wider food system are examples of experiential education.

Based on these overall theoretical concepts, an analytical framework was developed for each of the three key concepts to operationalize these concepts into broader albeit more concrete categories to develop questions and interview guides. Teachers' and farmers' perception, values and learning objectives related to food literacy were along the way assessed and compared to these initial criteria, and later further developed based on the empirical findings.

Table 3: Analytical framework operationalizing food literacy

Food literacy
Knowledge and skills:
Comprehensive knowledge about food and agriculture; origins, seasonality, production, distribution, consumption and disposal, impacts on health, environment and social issues from the individual to community and beyond.
Ability to work with food in practice and the ecological foundation of food (incl. growing and/or cooking food)
Using knowledge about nutrition, hygiene and environmental impacts when composing a meal.
Knowing about possibilities for making food choices and the food system more sustainable.
Attitudes and commitments:
Students' pro-environmental attitudes
Commitment and motivation to work with food issues and to contribute to positive solutions.
Actions and visions:
Implementation of concrete actions in food related activities
Students' active participation in and motivation for engaging in concrete actions in food related activities
Focus on and development of visions and creativity of what the food system could be like in the future incl. students' own ideas and perceptions about the future

Table 4: Analytical framework operationalizing food citizenship

Food citizenship
Democratic ideals, participatory and action-oriented teaching–learning:
Objectives and activities reflect democratic ideals, participatory and action-oriented teaching helping students develop ability, motivation and desire to play an active role in finding democratic solutions connected to SD
Connections to/ dialogue with the community:
Objectives reflect goals of action competence and practice connected to the community and focusing on dialogue
Critical thinking and future visions:
Learning approach focuses on critical thinking and the critical process of reflection and inquiry based on an empathetic and optimistic vision of potential
Development of students' ability and desire to play an active role in democratic and sustainable solutions:
Learning in an open-ended way, developing knowledge, values and skills focusing on ability and desire to play an active role in sustainable solutions

Table 5: Analytical framework operationalizing Education for Sustainable Development

Education for Sustainable Development
Learning *about* Sustainability
Participating in considerations and mutual learning about SD.
Reflecting on risks, uncertainties and complexities in relation to one's own as well as the practice of others.
Acknowledging, reflecting and discussing SD as something that requires discussion of values in relation to possible solutions.
Analysing limited SD as problems and challenges of understanding social, cultural, economic, ecological, institutional and political structures, dynamic cooperation, power relations, resource distribution and historical courses of development.
Comprehending and handling ecological contexts as well as contexts between societal and ecological development, globally and locally.
Relating ethically, actively, democratically, critically and constructively/innovatively to SD as socio-cultural change processes on all levels
Educatio*nal principles* for working with sustainability
Thinking and working in an interdisciplinary, holistic and problem-solving manner.
Working with power relations and conflicting interests, e.g., in the local situation, between countries, between current and future generations
Presenting arguments for different positions
Emphasizing capacity building and action, involving experiential exploration of sustainable institutions/communities/solutions and visions for the future, promoting reflexive learning
Looking for examples useful in other situations and for alternative actions
Looking at issues from different perspectives, to develop empathy by identifying themselves with others.

2.5. Research methods

In this section, the more specific research methods will be elaborated including considerations related to data collection procedures and ethical considerations.

2.4.1. Qualitative interviews

Based on the research questions, working questions and the operationalization of theoretical concepts presented under the theoretical framework in 2.4., semi-structured interview guides were developed.

The interview guides were divided into the following themes of questions but adapted to the type of interviewee (farmer or teachers) in table 6.

Table 6: Overview of interview themes (see Annex 5 for details)

• Background of the interviewee,
• Motivation for engaging in farm visits,
• Purpose of the farm visit and its integration into the curriculum,
• Content of the teaching,
• Learning goals and methods,
• Role of the teacher and farmers and their collaboration,
• Own values related to nature, food and sustainability,
• Experiences of children's learning during the teaching and farm visits,
• Barriers and opportunities in farm-school collaboration.

The interviews started off with open-ended questions not following strictly the order mentioned above, for which reason many of the questions were answered without the interference of the interviewer. This also was to avoid leading questions. Analytical and follow-up questions were asked along the way to ensure - what Kvale and Brinkmann talk about - an interpretation and analysis during the interview (Kvale, Brinkmann 2009). Specific questions on content, methods and learning goals related to the specific topic of the research i.e. food literacy, sustainability topics and action competence, were asked as follow-up questions, if the interviewees did not specifically mention these topics themselves. Consideration was given to both understand what they meant by these terms without making assumptions that they understood the same as the researcher. Most interviews with farmers and teachers were 1 – 1.5 hours long either by phone or at the farmer's or teacher's work. However, with one teacher it was only about 20 minutes due to reluctance to talk. Interviews with consultants or representatives from DAFC, OD, the producers' association for Organic Schoolyards, Coop Denmark and the educational expert were close to 2 hours.

As a dynamic qualitative research process, the interview guides were slightly altered along the way to adapt them to new insights and new information.

Interviews were conducted with farmers, teachers and key informants from primarily the Danish Food and Agriculture Council, the producers' association for Organic Schoolyards, Coop Denmark and the Faculty of Pedagogy and Didactics at Aarhus University (AU). The organic producers' association for Organic Schoolyards (initiated by farmers from Organic Denmark) and DAFC were selected as they are the key organizations offering farm visits and educational resources to schools related to food and agriculture in Denmark. Stakeholders from Coop and AU were contacted due to

their involvement in farm visits and development of educational resources. Altogether 9 teachers and 6 farmers were interviewed across the 4 cases. Interviews were conducted either in person or by phone, depending on the availability of the interviewees. All interviews were recorded and later transcribed word by word except for two interviews with teachers that were not comfortable with this. Instead notes were taken and a summary of the interview was written right after the interview.

Six interviews with key informants were also largely conducted using semi-structured interview guides and recordings. However, not all interviews were transcribed word by word due to their long length and parts were not relevant to the study. Some were also informal talks, for which reason some of the interviews with key informants were written in condensed form.

2.4.2. Observations

In all case studies apart from one, observations were conducted on-farm during a farm visit or elsewhere where the teachers and farmers were doing activities (e.g. the science centre and a forest). In case study 4, where the focus was on the whole school approach of the school more than on the collaboration with the farm (which was similar to case study 1), no observation was conducted.

The purpose of the observations was to observe the setting, students' reaction to the setting and the farmer, interactions between the farmer, students and teachers, the content and activities/methods used during the farm visits, factors influencing the visit and other relevant verbal and non-verbal information. The observations were one of the methods used to triangulate the data and get new direct insights, which could not be obtained through interviews.

The role of the researcher has been to be an *observer-as-participant*. Inspired by Gold (1958), Bryman (2004) talks of four participant observer roles based on degrees of interaction or involvement with the field:

1. Complete observer
2. *Observer-as-participant,*
3. Participant-as-observer,
4. Complete participant. (Bryman 2004)

During the observations on field visits and other activities, the researcher attempted to have as little impact on the learning situations as possible, thus with minimal participation. No video recording was performed to avoid distracting the students' attention during their farm visit and other activities. When there was an opportunity to ask informal questions to the students, the teacher and farmer it was done to a limited extent primarily during a lunch break or before and after the visit. Although it was not the purpose of the study, the researcher had informal conversations with the students after the farm visits either back at the school or in the bus in case studies 1 and 2 to get some insight into their experiences and views in addition to what was observed.

To get an understanding of farm-school collaboration and school garden practice internationally, two field trips were made to respectively the Bay area, California in the US and the region Oldenburger Münsterland, especially the Vechta district, in Lower Saxony, Germany. These insights have been used in the reflections on the Danish context and as inspiration for the recommendations.

2.4.3. Data collection procedures, bias and ethical considerations

Interviewees were contacted by email or phone beforehand and provided with a short description of the purpose of the interview and the study. Before an interview, the interviewee also received the document "Informed consent form" either by email or printed version before the interview. The form was provided to inform about the right to agree or disagree with the interview being recorded. Names of interviewees and have been changed into abbreviations and geographical locations of the case study sites have been concealed in the following chapters to ensure anonymity. The interviewees were given the right to review and comment on the transcriptions of the interviews to assure accuracy. Since the topic of the research is regarded by farmers and most teachers as uncontroversial, the majority of interviewees spoke rather freely about their experiences and opinions. Only two teachers were reluctant to talk and be interviewed. However, after some follow-up phone calls and meeting them in person, they opened up. Their reluctance was interpreted as lack of knowledge about agriculture and a feeling of unease exposing this. Since all but these two teachers were rather eager to spread the knowledge about their projects to others, the geographical location of the case sights is concealed to ensure confidentiality.

2.4.4. Educational materials

The following types of educational materials related to food, agriculture and sustainability were accessed, collected and analysed prior to and during August/September 2013:

- Books/pamphlets about food and agricultural topics
- Workbooks/worksheets with some text and a short comprehension test at the end
- Exercises or experiments to be done during or after a farm visits
- Online interactive resources, including games and quizzes about the farm, agriculture, food consumption etc.
- Films about e.g. a farm, a farmer's life, conventional and organic production.

The sources of educational materials were:

1. All the educational materials related to food and agriculture available from the Danish Agriculture and Food Council and the producers' association for organic schoolyards ('økologiske skolegårde') either in printed or on-line versions.
2. Educational materials used by the teachers interviewed, including exercises developed by the teachers or found elsewhere. Students' assignments were included whenever possible.

3. YouTube movies in Danish related to food, agriculture, organic agriculture, farm-to-table, sustainability issues targeting children were analysed as well.
4. Educational materials related to food and agriculture available through the websites of:

- EMU – Danmarks læringssportal (Danish Educational portal): http://www.emu.dk/ (Undervisningsministeriet (Ministry of Education) Uni-C Styrelsen for IT og Læring 2013)[5]
- Danmarks Radio, DR Skole (Denmark's Radio, DR School): http://www.dr.dk/skole (Danmarks Radio (Denmark's Radio) N/A)

These are website where educational materials, e.g. movie clips and written materials, are widely known and available to teachers. This is also where the teachers interviewed had found materials to use in their teaching. The website was, however, updated after the review and analysis of educational materials was completed, for which reason an up-to-date analysis of the new materials and improved website was not possible.

Additional educational resources from the following organisations were included as well:

- Coop Denmark A/S (the school division of Denmark's leading consumer goods retailer) Skolekontakten: http://www.skolekontakten.dk/(Coop Skolekontakt 2012)
- The Danish Ecological Council (Økologisk Råd, a Danish NGO promoting sustainable development through policy-advocacy and educational resources): http://www.ecocouncil.dk/en/(Økologisk Råd (Danish Ecological Council) 2013)
- Educational books for students developed for Haver til Maver school garden project (Gardens for Bellies), which integrate the aforementioned issues. (Laursen 2007, Keller 2009)

See annex 2 and 3 for further details. Although none of the teachers mentioned using educational resources from Coop Denmark and the Ecological Council, their materials were included in the analysis to get a broader picture of what educational materials are already available. All materials were reviewed, interpreted and categorized into themes of learning goals based on content and methods, if specific learning goals were not mentioned.

2.6. Data analysis strategy, process and procedures

In the following section, the data analysis strategy will be presented as a step-by-step description of this process and how Nvivo was used to assist the process. As illustrated in the section below, Nvivo was used to organize the data and do categorizations and nodes of the data. As already mentioned in section 2.5., data was analyzed in an on-going process throughout the research

[5] The EMU website was revised and updated into a new and better format, which was launched on 9 October 2013. The analysis of the educational materials on the EMU website was conducted prior to this for which reason the new educational materials and improved portal were not included in the analysis.

process. For this reason, the step-by-step process described below was not as rigid as described here.

2.6.1. Process and procedures

The following steps were taken:

1. Interviews and transcriptions

Apart from analysing the meaning of the interviewees' experiences and life-worlds along the way in the interviews, I also listened to the interviews a few times and transcribed them myself to ensure a better understanding and interpretation. Some of the reflections and interpretations were noted in log books.

2. Review of data and initial categorization

After all interviews were completed, all transcripts were read and an initial analysis and matrix overview was developed of what themes to go into depth with to answer the research questions. Case study reports were written based on this and included information from interviews, observations, webpages of schools and farmers. The primary focus of the case study reports was to get a short background description of the case including: development of the farm-school collaboration, main stakeholders, activities and collaboration arrangements.

3. Organizing data in Nvivo

Nvivo 10 was used at a relatively late stage in the process after the data collection was completed. Upon completion of the data collection, transcription of interviews and writing of case study reports, all empirical data (interview transcriptions, summaries of observations, case study reports and logbooks) were uploaded in Nvivo10 organized case study by case study. Educational materials were not added and categorized in Nvivo due to the fact that several were hard copies of books, leaflets and DVDs. Instead a matrix was developed where learning goals, content/descriptions and methods were included for each. Afterwards the learning goals were categorized.

4. Empirical categorization

After the organization of the data into Nvivo, another round of reading through all the data was done, while making categories and 'nodes' in Nvivo. This process was done to extract the meanings (life worlds) of the interviewees related to the study into categories and 'nodes'. This lead to a long list of categories and nodes related to the research questions. Some categories and nodes, however, were new. Categories and sub-categories of nodes were made to highlight differences within e.g. the category of learning goals. As an example, a long list of nodes under the overall category 'learning goals' was made, in order to further categorize the different learning goals. Additionally, new nodes were created from the data, which came from the data e.g. the learning environment.

This process led to a long list of categories and nodes, which was too unstructured and extensive to give a good overview and be a helpful tool for the further analysis. See photo 1.

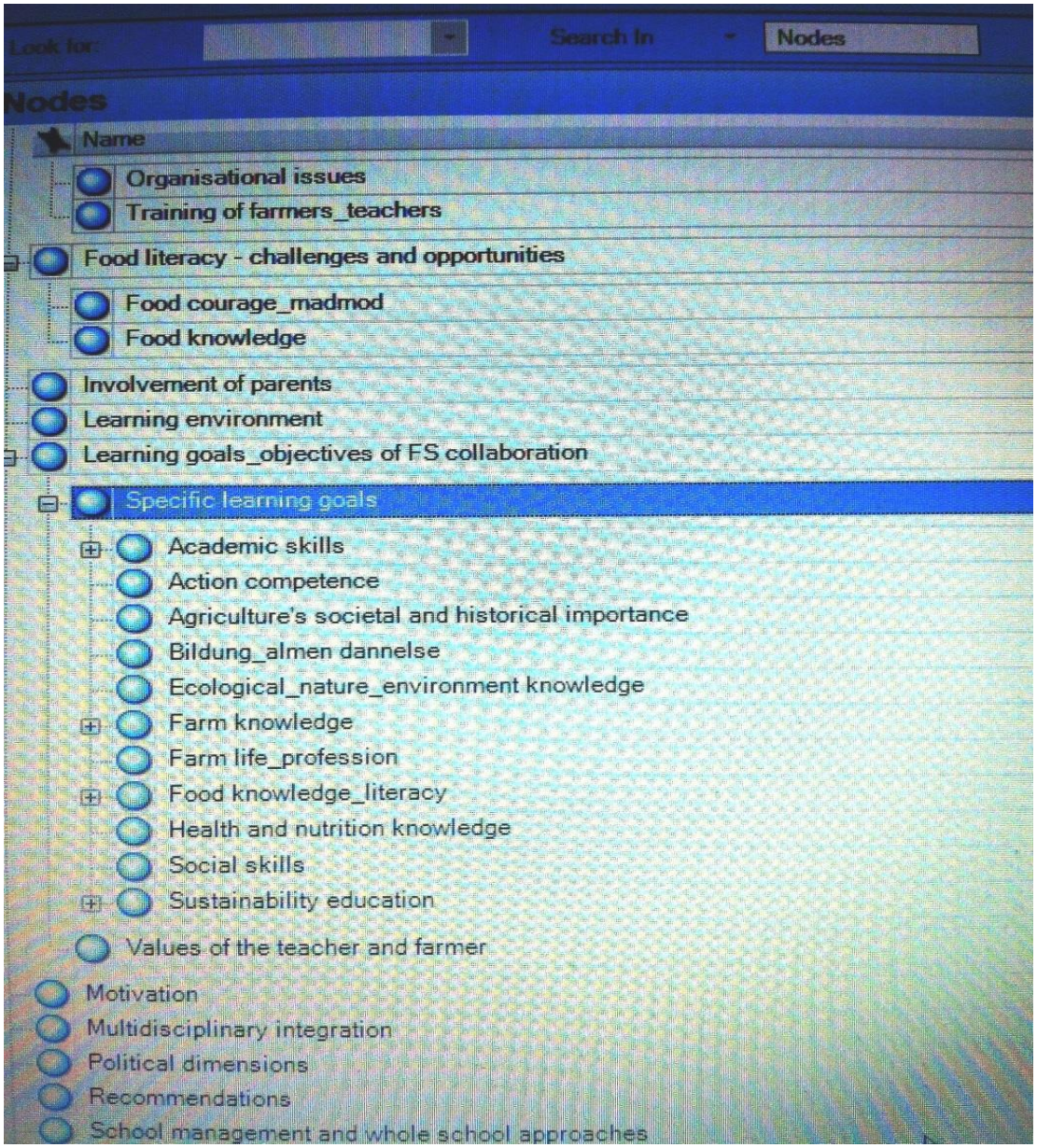

Photo 1: Initial Nvivo nodes

5. Re-organization of the categories

To structure the categories better, another round of reviewing the categories was done and some were merged. This created a better and clearer overview for the next step. Some of the sub-nodes related to e.g. learning goals, were kept. From ten overall categories plus the sub-nodes, this process reduced the overall categories to seven.

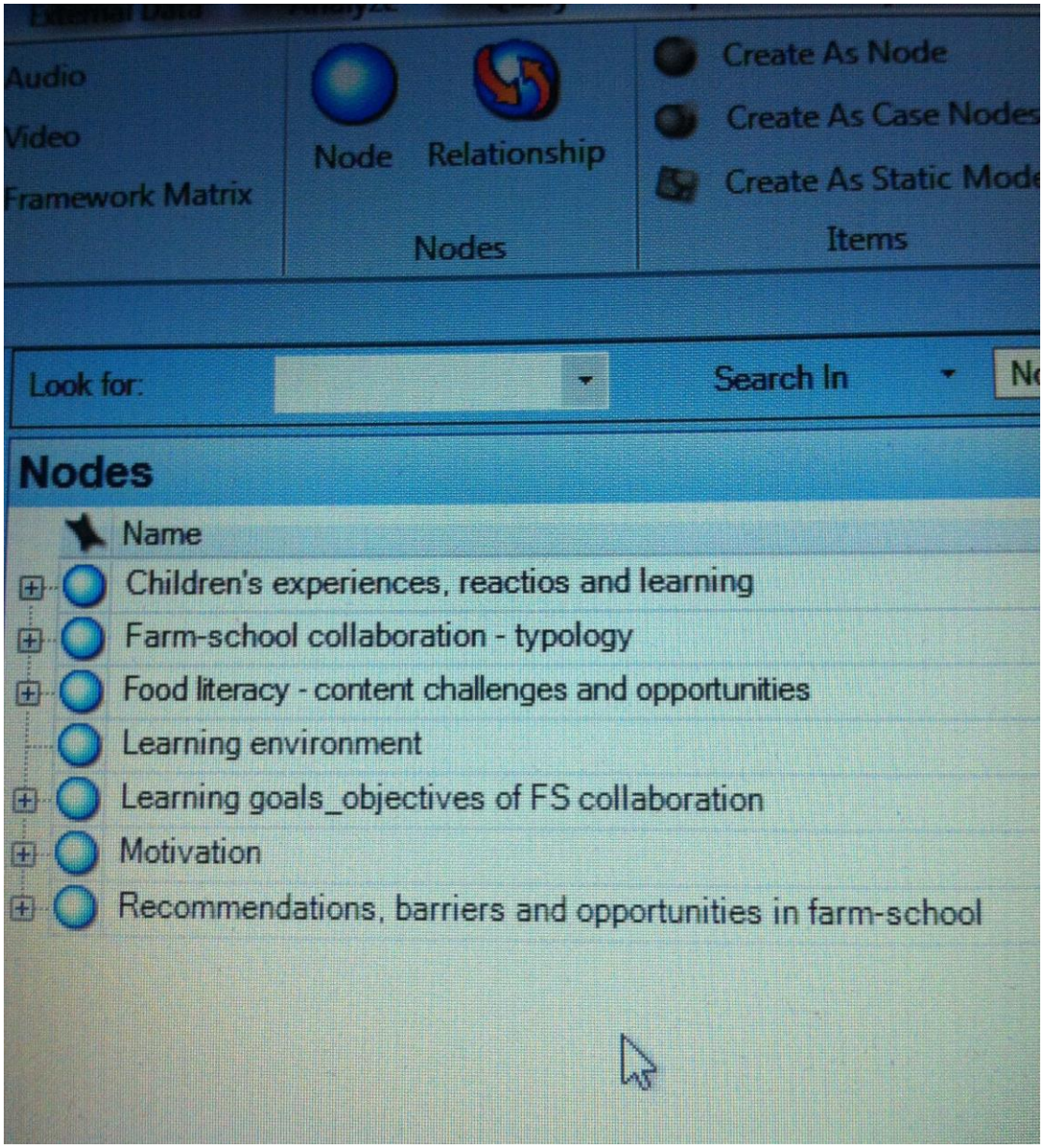

Photo 2: Revised Nvivo coding

6. Analysis and results

With the more structured organization of categories and nodes, linked to the research questions, theoretical framework and new findings, the process of writing could commence. When writing about 'motivation' as an example, Nvivo was used to do searches in all the sources that had nodes related to 'motivation.' Searches were made in the nodes on 'motivation' based on primarily type of interviewee (e.g. farmer, teacher or interest organization). Searches on specific case studies were also done.

2.6.2. Triangulation

As in the hermeneutic phenomenological tradition, the interpretation of the data was done in multiple ways and stages as an on-going process (Laverty 2008, Højbjerg 2004). As mentioned, some interpretation was done during the data collection phase including during the interviews, afterwards in log books and by following leads from previous interviews in proceeding interviews. Mid-way through the data collection phase, two conference papers were written with preliminary findings shared at conferences with other researchers in the field of farm education/farm-school collaboration. The same papers were also shared with DAFC and OD staff for their feedback. Thus, follow-up interviews and conversations were made to ensure the credibility of the analysis and findings.

In the analysis phase - mostly during the writing part but also earlier - themes or categories were analysed using multiple sources of data. For instance when analysing categories such as 'learning goals' and 'educational content and activities', interview data was used e.g. statements by teachers and farmers and later on the content, activities and learning goals of the educational materials were analysed and interpreted. When learning goals were not directly stated in the educational materials, this was either interpreted from the content, i.e. doing an interpretation of meaning (Kvale, Brinkmann 2009). If the interviews with teachers or the educational expert had shed some light on the learning goals behind the educational materials, this was included in the analysis of the materials.

2.6.3. Abduction - Theory informing the data analysis and the data informing theory

As mentioned, the theoretical framework guided the formulation of the interview guides and the preliminary analysis of findings. The process of categorising the empirical data was based partly on the research questions and partly on the theoretical framework to structure and analyse the findings presented in chapters 4 and 5.

Based on some of the findings from interviews and conferences, a new term/concept was introduced in chapter 6: there was a realization that in addition to food literacy, many farmers and their organizations especially, but also some teachers highlighted the importance of understanding agriculture. Since this was expressed as a learning goal different from food literacy, agricultural literacy was discovered as a new term, which has already been researched especially in the US. Through this realisation and additional review of research, the term was included in theoretical chapter 6. Chapter 6 in other words provides an elaboration of the initial theoretical framework presented in this chapter and is informed partly by the empirical data and expanded on the theoretical perspectives by including more research and conceptual work.

Especially in chapter 7 and to some extent also in chapter 8, this is taken even further when the empirical findings from Denmark on farm-school collaboration is analysed further within a food literacy, agricultural literacy, food citizenship and ESD context based on the findings from chapter 6 and new theoretical perspectives were developed.

2.6.4. Using the hermeneutic circle to interpret interviewee's values, practice and perception in the case studies

Understanding the interviewees' practices, perceptions and values was done through an interpretation of their narratives of how they work (content and methods) and their underlying learning goals and motivation asked through open-ended questions and follow-up questions. A mix between interpreting their specific statements and interpreting the whole was the way of analysing this. This gave an insight into their learning goals and values related to food literacy, food citizenship, action competence and sustainability, or if not, what other learning goals and values were important to them.

2.6.5. Analysis strategy

In the data collection process and in the analysis, the key terms of the research have been defined and observed in the following way:

Learning

To understand what is meant by learning goals, it is necessary to first look at learning. Illeris (1999), a Danish education researcher, defined learning as both a cognitive process inspired by Piaget, a psychodynamic process inspired by Freud as well as a social and societal process inspired by Marx. The *cognitive process* of learning has to do with development of skills, meaning and behaviour. In the context of this research, it has to do with the development of various skills, like science skills, gardening skills of the students as well as their behaviour related to food and nature and towards others. The *psychodynamic process* is about learning and communicating through feelings, views and motivation, which can be mobilized and influenced through the learning process. (Illeris 1999) This is linked to affective and positional learning goals. Understanding teachers' and farmers' observations and interpretations of children's learning is also an example of working with feelings, views and motivation produced through the psychodynamic process outside the classroom with real life issues. This relates to John Dewey's experiential learning philosophy. According to Dewey, learning is fostered and enhanced through the individual's own actions, thoughts and experimentation in practice and in the surrounding society (Vaage 2000). The farm-school activities are a good example of this. Dewey stressed:

"it is a sound educational principle that students should be introduced to scientific subject matter and be initiated into its facts and laws through acquaintance with everyday social applications" (Dewey 1938) (p. 80).

Dewey believed that applying this method was the most direct path to understanding science, economic, and industrial problems in present society (Dewey 1938).

This takes us to the next dimension: the *social and societal dimension* of learning is both about the social interaction between individuals during the learning process and also about the underlying

societal conditions, which influence the nature of the interaction and the individual learners' participation in it e.g. as part of the socialization process into the societal structures. It is about the social and societal contexts and how the individual acts in relation to this (Illeris 1999). It the context of this research, it is about understanding how teachers observe the social interactions outside the classroom (e.g. between students and their peers, and students and farmers) and their interpretation of the impact on learning and how teachers and farmers work with societal issues of food and farming if it is linked to individual action.

Learning goals

An important component of a learning process is the intended learning goal, which along with the motivation and values, is the key areas of this research. According to Hiim and Hippe's (1997) didactic relations thinking, learning goals need to be assessed according to other factors like the learning prerequisites of the students (e.g. age), the learning process, content, evaluation, and framework conditions (e.g. the Ministry's Common goals for the different subjects and conditions in terms of hours, economic considerations etc.). (Hiim, Hippe 1997) In this research, it is not been possible or the focus to look at and evaluate the students' actual learning, only the intended learning goals. However, when analysing the learning goals, the learning process and methods, content and learning prerequisites will be taken into consideration as well at the framework conditions in terms of economic factors and requirements (i.e. overall curriculum aims) by the Ministry of Children and Education.

Learning goals are about being explicit and aware of the purpose of the teaching. They highlight the importance of uniting the goals with appropriate teaching methods, students' prerequisites and framework conditions. (Hiim, Hippe 1997) In this research, learning goals are analysed as either explicit written statement about the purpose of the teaching or oral statements by the teachers and farmers. The learning goals in written educational materials did not always include explicit written learning goals. In these cases, the learning goals were interpreted based on the content and teaching methods. When analysing learning goals, the aforementioned other didactic factors will also be taken into consideration, although not analysed in depth.

Hiim and Hippe distinguish between three types of learning goals: *cognitive/knowledge* goals, *positional/affective* goals and *skill-related* goals. Although these goals can be separated in didactic relations thinking, the importance of merging students' cognitive learning with feelings and skills are emphasized. (Hiim, Hippe 1997) This could for instance be about combining the aim of developing the students' knowledge about agriculture and food, with affective dimensions (e.g. connecting with the farmer or with nature) or forming opinions about agriculture, with the development of skills to do something, e.g. grow or cook their own food. This is similar to the four dimension of the learning process, which Carlsson and Benn (2010) talk about (see section 2.4.): to know (knowledge), to be able to (skills), to want and to be (affective) (Carlsson, Benn 2010).

Values

Values are also closely tied to learning goals as they underlie reflections over learning, education and bildung (Wistoft 2009). There are in other words values behind what educators and others believe students ought to learn and how. Food literacy, action competence, and outdoor and experiential learning are related to values on food, learning and teaching methods. A value is the difference with which one observes something; a preference over something else. Values are therefore *differences* and presupposes a ranking order, in other words that something is better or more correct than something else (Luhmann 1995, Wistoft 2009).

Analysing motivation

When analysing the motivation of farmers, teachers and interest organizations, the statements from interviews will be used. Specific statements by the different interviewees will be presented as examples of motivating factors. Analysing the specific statements will then be used to give an overall assessment of the main motivation factors. Since the motivations are likely to be different depending on whether the interviewee is a farmer or a teacher, the motivations will be analysed separately for respectively farmers, interest organizations and teachers. Since external and internal factors such as the collaboration arrangements, structural factors (challenges and opportunities) and prerequisites of the teachers are likely to influence their motivation, such factors have also been considered in the analysis.

Analysing learning goals

From the interviews explicit statements about the interviewees learning goals are included and sometimes quoted to give examples and other times meanings are extracted from the overall interpretations. To come to these interpretations, all interviews are coded in Nvivo, with various nodes related to learning goals. Eight nodes are identified from the interviews and statements from the interviews that encompass these overall categories are made into nodes:

- Farm and agricultural knowledge
- Food knowledge – food literacy
- Ecological, nature and environment knowledge
- General and specific academic skills
- Social skills
- Life skills – 'bildung'
- Action competence
- Sustainability understanding

These eight nodes related to learning goals are different from the seven overall categories mentioned earlier related to Nvivo: of these seven overall categories or nodes, 'learning goals' was one of them, which again has the eight sub-nodes above.

Based on the eight different nodes above, a mix of overall analysis and specific examples in the form of quotes are presented. When analysing learning goals, categorizations are not done in Nvivo due to the mix of educational materials, e.g. hard copies and DVDs. Instead categorizations are made in two matrices: one for written materials and one for videos/film. The written statements in educational materials in the form of explicit learning goals are included but also the more implicit learning goals interpreted based on content and teaching methods are included. The latter is also true for the DVDs and Youtube films.

Analysing values

As mentioned, behind learning goals are some either explicit or implicit values. I will take a closer look at what these values are behind the learning goals of the teachers and to some extent farmers as well. Individual values cannot be directly observed and due to limited time spent interviewing each interviewee the main way of investigating values will be to look at personal values of the teachers and farmers, i.e. what is communicated, through an interpretation of interviews as a whole and through examples of specific parts and statements. The focus is on values relevant to the context of education, food and nature, which are connected to the key concepts of food literacy, citizenship and ESD.

2.7. Credibility, rigor and limitations

The overall credibility of the study is the researcher's ability to capture the perspective of the participants and represent it accurately. This has been ensured partly through sharing interview transcripts with the interviewees and getting feedback on preliminary observations, reflections and findings informally in the interview situation, and partly later on with representatives from DAFC and OD, through the literature review of related research and through sharing my preliminary findings in conference papers and presentations with other experts (researchers and practitioners) in the field. Furthermore, field visits to the USA and Germany were organized after the completion of the data collection phase. Here the preliminary findings were also presented and discussed and visits to sites where teachers, farmers and other stakeholders were collaborating on food and agriculture education assisted my reflections and analysis; getting feedback, new insights and confirmation of the preliminary interpretations of the situation in the Danish context. Understanding the differences between the US and German contexts and the Danish assisted me in better understanding the Danish cases and context. It contributed to an understanding of similarities and differences in farm-school collaboration across the countries. It also confirmed my understanding and interpretation of farmers' and teachers' motivation and barriers and opportunities, while also providing inspiration to new ways of organizing the collaboration and working with food and agricultural education and farm-school collaboration.

Ensuring rigor in the study was done by ensuring that the interviewees had time to talk, avoiding leading questions, that the interviews were recorded and transcribed accurately. Since the topic of research was regarded by farmers and most teachers as uncontroversial, the majority of interviewees seemed to express their unconcealed opinions.

A limitation in the interviews is that it was difficult in general to ask about certain topics like values and sustainability understanding and teaching. Also time constraints during the interviews were a challenge for getting an in-depth understanding of this. The interviews were about 1 – 1.5 hours long and as mentioned mostly open-ended questions. When asked specifically about their understanding and use of sustainability topics in their teaching, all had an understanding of the term 'sustainability' and 'sustainable development', but no-one had heard of 'Education for Sustainable Development.' Even though they were all familiar with the former terms, there was limited time to get a more in-depth understanding of how the interviewees understood the terms, for which reason a thorough understanding of how they saw the terms and worked with them is limited. Having four cases instead of only one also limited the time for follow-up interviews, more observations and interviews with more teachers at the schools. However, the research approach was still suitable for answering the research questions. Another limitation, which has been clear from the beginning of the research, is that the hermeneutic phenomenological approach first and foremost provides an understanding of the didactical considerations, i.e. the intentional and interpretable aspects of the teaching. The research cannot document if the actual teaching and learning of the students in fact rendered the learning intended.

Chapter 3 Review of farm- and garden-based learning, farm-school programs and outdoor education research

In order to place this research on motivation, values and learning goals in farm-school collaboration in Denmark within existing international research, this chapter will give an overview primarily of the research related to practice and impact of farm- and garden-based education, farm-school programs and outdoor education. In addition, some studies on the problem, which these programs are targeting such as unhealthy food consumption patterns, loss of food preparation skills and limited understanding of agriculture and the food system etc., will be presented. The purpose is to get an overview of existing research on practice, evidence of the impact and other findings, as well as the research gap within which this Ph.D. project is placed. The review will also look into the rationales underlying farm- and garden based learning and outdoor education.

3.1. Introduction

Educational programs and research draw attention to the problem that in globalized food system and urbanized societies, children are losing connection to nature, agriculture, food production and knowing about the process from farm to table (Hess, Texler 2011, Harmon, Maretzki 2006). This includes understanding the complexity of how and where food is produced and having an understanding of seasonality, quality and diversity of food. Loss of cooking skills, increased consumption of highly processed foods, and difficulties understanding food labels all pose a challenge for public health with increasing obesity rates and other diet related health challenges. Furthermore, unsustainable patterns in the food chain and consumption play a significant role in environmental destruction, loss of biodiversity, greenhouse gas emissions affecting climate change, erosion of local farm culture and economy. Many food and health advocates and researcher argue that an understanding of and concern for some of these factors, can help qualify people's food choices to consider its impact on health and the environment.

Although the potential for student involvement and learning about food production, nutrition, health and sustainability through on-farm activities is recognized especially within school nutrition-, agriculture-, and environmental education circles, the scientific attention is still rather limited. There is a wealth of farm-school and school garden programs across the US, Canada, Australia, Brazil as well as the UK, Ireland, Germany, Norway, Italy and Denmark to mention a few. This cooperation is very varied – ranging from a focus on school food supply produced by local farmers or collaboration related to food and farm education e.g. through farm visits, or a combination of the two. In the Danish case, the practice of collaboration is almost entirely focused on educational aspects, although a few examples of more whole-school approaches integrating food supply, food service and learning are emerging as well (Ruge, Mikkelsen 2013).

DAFC and OD have programs and educational materials connecting students with local farms for educational purposes. In addition to the underlying health, environmental and sustainability

objectives behind many of these programs, there are also academic objectives and benefits from out-of-school activities, which both garden-based and outdoor education programs and research highlight.

3.2. Food and agricultural literacy and other challenges

Some of the challenges facing our children and adults today are as mentioned above on the one hand a loss of connectedness to nature and to agriculture and the broader food system, which most people were much more connected to only a few generations ago. Understanding an increasingly complex food system is a challenge for children and adults alike, for which reason making environmentally friendly and ethically appropriate choices becomes a challenge. Finally, increasing concerns over people's including children's limited cooking skills are tied to increases in nutrition-related health challenges facing today's societies. Some of the research focuses specifically on documenting these problems. Before looking into this research on practice and related impacts, benefits and rationales behind, a short overview of the research on the problems will be provided.

3.2.1. Changing food consumption patterns and food preparation skills

Chenhall (2010) reviewed 40 publications related to cooking and food preparation skills among children and families in Canada and internationally. Some of the challenges influencing the decline or change in cooking skills and food preparation culture are according to Chenhall linked with several technological, food system-related and broader shifts within the social, economic, physical and cultural environments. This includes increased availability of food commodities, especially processed; improved and advanced technology for food storage, preparation and cooking resulting in changes in the level of cooking knowledge and skill; labour market participation demanding more out-of-home work; and finally decreased opportunities for cooking and food preparation skill acquisition within the home and education environments. (Chenhall 2010)

According to Chenhall (2010), research on food purchasing and consumption data confirm a shift in food choice and consumption patterns linked with increased consumption of processed, pre-prepared and convenience foods 'assembled' and consumed across different socio-economic sub-groups on a daily basis. Many of the studies reviewed revealed that adolescents do report involvement in food purchasing and preparation activities. However, for most not more than once or twice per week with female adolescents, and with lower SES groups reporting greater involvement than those from mid and high SES groups. (Chenhall 2010) Without observing and practicing basic cooking and food preparation skills in the home environment, many argue that children and adolescents will not have the necessary skills to make informed choices within an increasingly complex food environment. In support of this argument, low self-efficacy and self-perceived inadequate cooking and food preparation skills have been identified as barriers to healthy food choice within several recent research initiatives, potentially resulting in a greater reliance on pre-prepared or convenience foods, reduced variety in food choice and consumption and in cooking and food preparation skills. (Chenhall 2010)

Caraher et al. (1999) and Lang and Caraher (1999) write about findings from British and European studies on declining cooking skills and suggest similar findings. They call attention to what they refer to as "a culinary transition," which is a fundamental shift in the pattern and kind of skills required to get food, where cooking skills are thought of as an essential one. The decline in cooking skills is seen as a result of lifestyle changes, where fewer people cook than earlier. According to Lang and Caraher, having cooking skills is an essential factor for having the necessary knowledge and skills about what constitutes a healthy diet and is part of empowering people to exercise control over their own diet and food intake by cooking and preparing their own meals. Lang and Garaher call attention to the importance of basic culinary proficiency, thereby pointing to one aspect of food literacy, which will be further elaborated in chapter 6. However, at the time of the studies, there was not any strong evidence on the link between an erosion of cooking skills and an impact on health. Caraher et al. (1999) in fact stressed that cooking skills are just one part of the complex food web impacting health. Later studies on this topic were not found, and it was not the key area of this research. (Lang, Caraher 1999, Caraher, Dixon et al. 1999)

3.2.2. Understanding the complexity of food and the food system

Limited understanding amongst children and the population at large of how and where our food is produced as well as the difficulty of understanding the complexity of the food system are also issues, which are viewed as key challenges to be addressed through various food and agriculture programs. In a qualitative study of New York City urban children's ideas of the food system, Barton et al. (2005) found that students interviewed were largely drawing their understanding on their reasoning and experiences in the home or with television rather than basing it on school-based knowledge. Yet they seemed to have an awareness of the complexity of the processes of moving food from farm to the store. They saw food as a commodity produced by farmers and transformed and packaged in factories into the food products they know and then sold in the supermarket. However, they did not have an understanding of food being from nature and produced to satisfy nutritional needs of people. Yet, they did seem to have an insight as to how complicated the food system is and the negative environmental impacts from the processing of food, packaging of food products, energy use or pollution. The students' ideas about how food is produced and its relation to personal health and global sustainability were rather tentative. Barton et al (2005) stress the critical importance of teaching about the complex issues related to food in elementary science education (especially relevant for the cognitive abilities in the age group of 4^{th}-6^{th} graders) in ways that link food with its impact on both the body and the continued sustainability of the natural environment. (Barton, Koch et al. 2005)

A qualitative study by Trexler et al. (2000) of 2^{nd} to 8^{th} grade teachers in Michigan in the US also found that few students comprehend the complexity of food production, distribution, and preservation system according to teachers. In fact, teachers perceived that students lacked an awareness of where their food came from and did not care how it arrived there, mentioning that youth often do not understand what food animals are or what products derive from them. They are

also frequently unable to identify a carrot as a vegetable. (Trexler, Johnson et al. 2000) This is supported by findings in a more recent qualitative study of 4^{th}-6^{th} graders in California by Hess and Trexler (2011), which shows that the students were able to readily name common food items, but lacked the ability to accurately elaborate on the origins of common foods. Findings also showed that none of the students had ever grown their own food, raised a plant, or cared for an animal. (Hess, Texler 2011)

A study by Harmon and Maretzki (2006) of high school students in the US also shows that the students found it difficult to see how their own individual behaviour is part of bigger food systems problems and how a choice in one part of the system can have impact on other parts of the food system (Harmon, Maretzki 2006).

Although the Trexler et al study from 2000 found that teachers believe it to be important that children understand the connections between humans, the environment and food system, few felt the need or focused on educating their students about these issues. Instead the study found that elementary school teachers wanted to teach students how to make healthier and better consumer choices about their food. A reason for this seemed to be that most teachers did not feel comfortable with agricultural concepts and the agri-food system and requested more support in the form of educational materials and training. (Trexler, Johnson et al. 2000)

That teachers' responses dealt primarily with nutrition and food education and not agri-food system education in this study is not surprising, since food at the individual level is more easily understood both by teachers and their students than the complexity of and interactions between humans, the environment and the wider food system. Nevertheless, these inactions and connections are important for understanding and making more sustainable food choices, for which reason Trexler et al highlight the need for developing educational materials that educate future consumers about sustainability issues and links between food, agriculture, biological principles and environmental impacts. This could enable children and future consumers to make food choices beyond their own health considerations but also taking environmental considerations. (Trexler, Johnson et al. 2000)

Although the studies above and others (Knobloch, Martin 2000, Knobloch, Ball et al. 2007) are from the US, similar challenges and concerns about the lack of knowledge, connectedness to food, agriculture and the agri-food system are noted by NGOs, agricultural organisations, teachers and researchers in Europe as well and form the background for food and agriculture education, farm-school collaboration and school garden programs in Europe as well. In the following sections, I will review the research on some of this practice.

3.3. School garden and garden-based learning research

Although school garden programs and related research are different from farm-school collaboration in that it typically takes place on school grounds and/or other places often in cities, it has been included there for a number of reasons. First of all, the amount of research on school gardens is

larger and secondly there are some similarities in the outdoor setting and teaching approaches, i.e. that students participate actively in activities in the school garden at the school or on the farm. Depending on the type of farm-school collaboration, especially where schools have a more permanent and longer-term collaboration with a farmer, there are likely to be similar benefits as the ones related to school gardens.

Much of the existing scientific research related to school gardens and garden-based learning are short-term intervention studies or evaluation of projects often focusing on documenting the impact on health and nutrition primarily linked to improving dietary intake of fruits and vegetables. This appears to be the case, since much of school garden research and current funding in the United States are framed within an underlying health promotion and obesity prevention discourse – linked also to a food literacy discourse (Ratcliffe 2007, Desmond, Grieshop et al. 2004). Many of these studies – mostly intervention studies - show for instance that children, who experience growing their own food, are more likely to try new foods and develop a preference for fruits and vegetables and therefore eat more of it (Evans, Ranjit et al. 2012, Ratcliffe 2007, Ratcliffe, Merrigan et al. 2011, Heim, Stang et al. 2009, Jaenke, Collins et al. 2012, Heim, Bauer et al. 2011).

A study by Heim et al. (2009 and 2011) for instance shows that the children shared their garden experiences at home, when participating in a Delicious and Nutritious Garden intervention, a component of a 12-week YMCA summer camp. Parents reported an increase in the frequency that their child asked for fruits and vegetables, however, so did home availability of fruit and vegetables and parental encouragement; thus making children's home food environment increasingly supportive of fruit and vegetable consumption. (Heim, Stang et al. 2009, Heim, Bauer et al. 2011) An evaluation from Ireland of the program Incredible Edibles by Horgan (2010)[6], however, found that the home environment was a key barrier to children's increased fruit and vegetable intake, as the home environment was not addressed in the program. This finding is a good example of how the involvement of parents and the home environment should be considered. (Horgan 2010)

Ratcliff et al. (2011) in a pre-post panel quantitative study in two intervention schools and one control school in the San Francisco area documented the effects of a school garden program amongst middle-school aged students on their knowledge, attitudes and behaviour concerning vegetable consumption. The study shows that school gardening can affect children's vegetable consumption. More specifically, students were better able to identify vegetables, than those in the control group and students participating in garden-based learning significantly increased their preference for and consumption of vegetables generally and for those grown in the school garden. They were more willing to taste vegetables and an increased variety of vegetables eaten was also documented. However, in this study the intervention did not have an effect on the home food environment, only the consumption of and preference for vegetables during school. (Ratcliffe, Merrigan et al. 2011) Studies by Ratcliffe (2007) and Heim et. al. (2009) identified similar findings

[6] Evaluation report, not peer-reviewed.

related to improved recognition of, attitudes toward, preferences for, and willingness to taste vegetables. (Ratcliffe 2007, Heim, Stang et al. 2009)

The importance of longer-term and multi-component food interventions are highlighted by some researchers (Evans, Ranjit et al. 2012, Poston, Shoemaker et al. 2005, O'Brien, Shoemaker 2006). Short-term programs, like after school gardening activities are less effective at changing fruit and vegetable preference and consumption amongst students than year-long programs in school (Poston, Shoemaker et al. 2005, O'Brien, Shoemaker 2006). A study by Evans et al (2012) looking at various models of food interventions in schools including school gardens showed that multi-component interventions have a greater impact on fruit and vegetable knowledge, preference and intake than only school garden activities. Multiple interventions include farm to school, farmers' visits to schools, taste testing, field trips to farms, and in-class lessons. (Evans, Ranjit et al. 2012) Although this review does not investigate the effects on fruits and vegetable knowledge, attitude and intake in details resulting from school garden interventions, it is a key point here in the studies above, that multiple and longer-term interventions including school gardening, farmers visits to schools, school visits to farms, taste education and in-class teaching are the most effective. Thus, it is fair to assume that single farm visits or a shorter school garden experience cannot stand alone, but have to be combined with other interventions in order to have a significant effect.

In addition to the nutritional aspects, the Ratcliffe study from 2007 documents that hands-on experiences from the school garden activities led to increased ecological knowledge and environmentally responsible behaviours, but no improvements in ecological attitudes (Ratcliffe 2007). School garden programs often include activities related to nutrition promotion and cooking activities, which result in greater knowledge about healthy eating. However, most school garden programs combine nutrition education with ecology and environmental education; fostering the potential for children to eat better, while also increasing their understanding of ecology (eco-literacy), connectedness to nature, ecological footprint and responsibility for the environment - thus promoting healthy and pro-environmental attitudes (Ratcliffe 2007, Skelly, Zajicek 1998, Skelly, Bradley 2007).

Related to eco-literacy or ecological knowledge, the Ratcliffe study (2007) showed that students participating in garden-based learning activities significantly increased their overall environmental science knowledge score. This included correct responses to questions conforming to the California State Standards for Sixth-grade Science. In other words, the finding suggests not only an increase in the overall ecological *knowledge*, but also that this knowledge improved the academic achievement of the students. In relation to ecological *attitudes*, there was a small, but non-statistically significant improvement in students' environmental attitudes after participating in the garden program. The study's qualitative interviews with teachers, however, suggested that the gardening experiences may have influenced students' attitudes towards soil and insects. Findings related to environmentally responsible *behaviour* suggest that students significantly increased the frequency of ecological behaviour according to their self-reported behaviour. According to Ratcliffe, the results from this study suggest that the documented changes in behaviour were *not* directly mediated by changes in

attitude. Therefore, the findings call into question the assumption that positive environmental attitudes are a necessary precursor to environmentally responsible behaviour. (Ratcliffe 2007) An evaluation study by Murphy (2003) of the Edible Schoolyard in Berkeley, CA also documented students' gains in understanding garden cycles (compared to a control school) and academic achievements in math and science also increased along with improved psychosocial adjustment. Apart from documenting these specific impacts, the study looked into how the garden can be used to promote holistic education and ESD, e.g. by combining ecological knowledge and understanding, environmental behaviour and attitudes, health promotion, interpersonal relationships and a sense of place. (Murphy 2003) Linked to ecological knowledge and environmental science scores studied in Murphy and Ratcliffe studies, other studies have also shown that school gardens can have a positive effect on students' attitudes toward science (Desmond, Grieshop et al. 2004, Skelly, Bradley 2007, Wistoft 2013).

Apart from the more direct effects related to improved nutrition, healthy eating habits, ecological knowledge and science attitudes, garden-based learning also has a number of other important effects, which in fact tend to be the case for other types of outdoor learning environments as well. Waliczek, Bradley and Zajicek (2001) looked into whether or not students participating in garden activities benefited in terms of improving interpersonal relationships and attitudes toward school. No significant differences were found between pre- and post-tests and the control and experimental group comparisons, which, however, might be due to the fact that it was conducted at the end of the school year. Demographic comparisons, however, offered interesting insights: female students had significantly more positive attitudes towards school at the conclusion of the garden program compared to males. This is surprising since there is often a perception that outdoor environments are especially appealing to boys, who are seen to be more in need of learning in a more physically active and outdoor environment. (Waliczek, Bradley et al. 2001)

The Waliczek, Bradley and Zajicek study also showed that there were differences in interpersonal relationships between children and the effect of gardening on students' attitudes towards schools depending on grade level. Students' attitudes toward school were more positive in schools that offered more intensive individualized gardening allowing children more individual participation in the garden, which was especially the case for older students. This is attributed to the fact that when the older students were allowed to work independently, it had a more positive influence on attitudes and socialisation, compared to the younger children who worked in more supervised conditions. Students working independently and who were encouraged to take responsibility for their actions in other words had a more positive attitude toward school. (Waliczek, Bradley et al. 2001)

Other benefits related to skills and personal development have also been argued for in relation to school garden programs, e.g. interpersonal skills, self-understanding and the ability to work in groups (Green 2004, Desmond, Grieshop et al. 2004, Wistoft, Otte et al. 2011, Murphy 2003). In the Desmond et al report[7], arguments are presented on the opportunity for children to improve self-

[7] Review report, not peer-reviewed

confidence and self-esteem through successful experiences in the garden by witnessing tangible results of their efforts. It is based on a review of garden based learning programs and research and written for the Food and Agriculture Organization and the International Institute of Educational Planning. Desmond et al. (2004) mention that school garden related activities can also increase school retention rates when children work in gardens and do hands-on activities including learning from each other. The connection to the soil can give students a sense of achievement, motivation and empowerment, which is another benefit presented here. The fact that nature can be used as an outdoor and real life learning laboratory for teaching science, math, social studies, art and languages is also mentioned as a positive benefit. A final argument is that a garden facilitates cooperation and communication, making teamwork an important goal in order to make the school garden work.(Desmond, Grieshop et al. 2004) The evidence related to the abovementioned benefits is more complex to document and still rather limited.

In addition to school gardens having an instrumental value in terms of developing healthy eating habits, environmentally responsible behaviour in children and improving their learning and interests in various subjects, other researchers and practitioners point to a more inherent or holistic value of garden-based learning. According to Green (2004)[8], it is a place where students can learn by using all their senses, and a place where connections can be made between mind, body and spirit: where connections between humans and nature and the importance of plants and other natural elements can be uncovered. Green further stresses that a school garden can be a place where the diversity of intelligences, abilities and personalities of each student can be discovered and explored. (Green 2004) The Green study is a Master's study based on qualitative interviews with teachers and other stakeholders and explores a school garden curriculum in Ontario, Canada and its relationship to holistic curriculum, which seeks to establish relationships between mind and body, different disciplines, people and the natural world. Although many school garden projects have this emphasis, there is only limited research with this angle.

In the Danish context, research is limited especially on farm-school collaboration but also in the area of school garden research. This is in spite of the fact that there is a long history in Denmark of both farm-school collaboration and school gardening dating back to the 1800s. The majority of research in the Danish context is on outdoor education more broadly. As an exception, a larger mixed method research was conducted to evaluate the school garden program *"Haver til Maver"* (Gardens for Bellies) program[ii] in the municipality of Fredensborg. Here all municipal schools and more than 10,000 students since 2003 have enrolled in the project and visit the farm and school gardens at Krogerup in Humlebæk eight times over a school year. Students learn about organic production in their own garden plot by a farmer, prepare meals in an outdoor kitchen with chefs and learn about the surrounding nature with the expertise of a nature guide. The overall goal of the program is to support students' learning and competencies and awareness about organic food, ecology and nature and cooking. The evaluation shows that the program supports the development of children's taste and knowledge about different vegetables, their origins and promotes their

[8] Masters'thesis, not peer-reviewed

motivation to engage in cooking, promoting their food literacy and sustainability understanding and with the ultimate goal of fostering children engaging in and forming critical opinions about food. (Wistoft, Otte et al. 2011)[9]

As it was the case with other studies (Ratcliffe 2007, Ratcliffe 2012, Heim, Stang et al. 2009, Desmond, Grieshop et al. 2004) Wistoft et al. (2011) documented that students participating in Gardens to Bellies are keen to eat the food they grow and prepare themselves, even vegetables they do not normally like. They also develop social skills; being polite, respectful and giving positive feedback on each other's cooking. (Wistoft, Otte et al. 2011) In addition, a key part of the pedagogical approach of the program is that the students learn from authentic teachers (a farmer, a chef and a nature guide) using all their senses, all of which promote a desire to learn and engages and motivates the students (Wistoft 2013). Finally, Wistoft et al. point to the fact that the outdoor setting gives room for teaching all kinds of students; both the academically weaker and stronger students, but also more loud and physically active children giving them all a positive experience (Wistoft, Otte et al. 2011).

3.4. Agricultural education and farm-to-school research

There are distinct differences in respectively farm/agricultural education research on the one hand and research on farm-school programs on the other: the former specifically looks at the content and learning goals, curricula integration and the role and knowledge of teachers and children's agricultural literacy (this will be elaborated in chapter 6). It is also one of the focus areas of this Ph.D. study of Danish teachers' learning goals and curriculum integration of farm-school collaboration and food and agricultural topics. The latter type of research focuses on the integration between food supply (often local and/or organic), school meals and food and farm education in schools taking on a broader Whole-School Approach[iii] to health promotion and food involving the whole school (e.g. school food service, practices, curriculum and connections to the wider community like farms). However, the research related to farm-school programs often focus on the economic aspects, stakeholders or on the food supply and provision of schools meal and less on the educational aspects. An example of this is a study from Italy of educational farms, which focuses on the economic aspects for farmers engaging in educational activities in their farms (Canavari, Huffaker et al. 2011). Similarly, a study on farm-to-school programs in Vermont, US by Conner et al (2011) looks at the actor network including flow of financial resources (Conner, King et al. 2011). Allen and Guthman (2006) look at the political philosophy, economic rationale and discourses behind farm-to-school programs (Allen, Guthman 2006).

Other studies focus on the supply of locally produced foods in the school food system combined with nutrition and food education and its impact on children's health and consumption of primarily fruits and vegetables. A review of 15 studies of farm-to-school programs in the US by Joshi et al (2008) documented increases in daily fruits and vegetable intake (Joshi, Azuma et al. 2008). A

[9] Evaluation report, not peer-reviewed

study surveying 632 elementary students in Vermont on personal characteristics and experiences with fruits and vegetable by Roche et al. (2012) also looked at dietary benefits of FtS programs (Roche, Conner et al. 2012). Similarly, Ratcliffe (2012) points out in a qualitative study and research review that Farm-to-school programs hold promise to address childhood obesity, and included interviews with food service directors in the Oregon. In fact several of the farm-to-school programs and related research are framed within either an obesity prevention discourse or one of providing economic benefits for farmers as mentioned above. Ratcliffe's point is that Farm-to-school programs can help increase students' access to healthier foods, but also students' knowledge of and desire to eat these foods and increase their consumption. The benefits of bringing different stakeholders together to prevent childhood obesity, such as nutritionist, educators, food service providers and food producers, are highlighted. (Ratcliffe 2012)

A recent study by Moss et al (2013) analysed the effects of the Coordinated Approach to Child Health's (CATCH) nutrition curriculum and farm-to-school program looking at the impact on nutrition knowledge and fruit and vegetable consumption behaviour of 3rd grade students. The program included two nutrition education classes and a farm tour. The results from this experimental study showed significant differences concerning knowledge of fibre ($p<0.001$) and knowledge of vitamins and minerals. Related to consumption, findings showed significant vegetable consumption behaviour at school and farm exposure ($p < 0.05$) suggesting that combining nutrition education and farm tours can positively affect school-aged children's nutrition knowledge and fruit and vegetable consumption. (Moss, Smith et al. 2013)

Other programs and studies have showed that farm-to-school programs have other benefits such as promoting life skills and eating habits (Joshi, Azuma et al. 2008, Graham, Freenstra et al. 2004), when the farm-to-school programs incorporate supply of healthy foods with classroom and farm- and garden-based educational activities. The former review showed that these educational activities can bring about increases in knowledge about growing cycles and sustainable agriculture and knowledge of gardening, including the ability to identify plants grown in the garden. Other impacts such as development of social skills and self-esteem, responsible behaviour and increased physical activity were also noted in some of these programs (Joshi, Azuma et al. 2008). It was found in this review that only few studies focus on teachers. This is also a finding in my review, with the exception of studies looking at outdoor education and agricultural literacy, the latter of which will be elaborated in chapter 6.

An emerging, yet still limited area of research is farm-based education research. Unfortunately, there is at present hardly any peer-reviewed scientific research in this area in English apart from several conference papers and abstracts. One exception is an urban farm project and related research by researchers at University of British Columbia in Canada. This farm-based project focuses on environmental education on-farm and was designed to bring elementary school children and community elders to work as partners to raise food crops on an urban organic farm. The goal was to illustrate how eco-philosophies could be translated into educational programs that foster environmental consciousness and care. Over a six year period, the practice of environmental

education evolved along with efforts to advance environmental understanding and stewardship through intergenerational farming. Initially the teachers highlighted the benefits of the farm activities of promoting science and theory-practice understanding, whereas the students emphasized the social, aesthetic and intergenerational learning as the most important. Over time, the program changed and more students and teachers mentioned feeling a connectedness to and understanding of the environment. A stronger sustainability focus and food systems understanding was added to the project over time. (Mayer-Smith, Bartosh et al. 2009)

Jolly and Krogh (unpublished) document in conference papers farm-school collaboration in Norway and highlight how these projects are run by family farmers using the farm as a setting for learning, focusing on place-based learning and the farmer as a role model for students to learn about farming and other practical trades, which the farmer is involved in at the farm. Merging farmers and teachers together in workshops facilitated by the Norwegian University of Life Sciences has been a way of creating a pedagogical arena for developing a collaboration and curricula for students to work with and care for nature, the local area and facilitating their experiences and connections on which to build an understanding about sustainability. (Jolly, Krogh Year N/A, Jolly, Krogh Year N/A)[10] Similar farm-school collaboration and learning on farms is taking place in other countries in Europe such as Germany, Finland, Poland, Austria and Holland, but with limited if any peer-reviewed research available (at least not in English language).

3.5. Teachers' role, beliefs and practices in food and agriculture education

Teachers play a key role in integrating food and agriculture teaching into primary education to provide an important fundamental understanding for future consumers and citizens. Much of the existing research available and presented in this review focus on documenting how various outdoor initiatives in schools and on farms influence students' learning, attitudes and behaviour related to nature, agriculture, food and nutrition. However, the beliefs, attitudes, knowledge, conditions and goals of teachers make up a critical prerequisite for what is taught about food and agriculture in the schools and how it is taught. Only few, qualitative studies presented below have in fact looked at the role of teachers and aim to document their beliefs, attitudes, experiences and conditions and how this affects their teaching on these topics.

Studies from the US show that many teachers struggle to teach agriculture due to limited knowledge and familiarity (Trexler, Hikawa 2001). A survey of teachers conducted by DAFC (see annex 4) also suggests that teachers in Denmark have limited familiarity with agriculture, which is likely to influence how and if they integrate agriculture into their teaching. This will be further elaborated in chapter 5. In a study using an open-ended survey of 452 participating teachers out of 2405 teachers in the state of Illinois, USA, Knobloch, Ball and Allen (2007) found that there are many teachers who do not include agriculture in their teaching. This is likely linked to the teachers' lack of connections to agriculture, or what can be referred to as "schema" (or the teachers' mental picture)

[10] Conference abstracts, year and publisher not available.

about agriculture and how this shapes the way they think about it and interpret information. (Knobloch, Ball et al. 2007) Trexler and Hikawa (2001) found that teachers' experiences and available resources influenced the development and use of agricultural curriculum materials, using knowledge based on their experiences and available resources. Teachers with prior agricultural experiences were more likely to integrate agriculture in their teaching. (Trexler, Hikawa 2001)

The Knobloch, Ball and Allen study (2007) found that the beliefs of teachers related to agriculture influence what and how they integrate agriculture into their teaching. Some of the teachers' beliefs about the benefits of teaching agriculture were that it provided their students with a connectedness: a connectedness to the land, their communities or region and to the world, but also to the students' everyday life. Teachers mentioned that it was important for their students to learn how to become future stewards of the environment, understanding the ecosystem. Another belief was that agricultural themes and the farm provide an authentic learning environment, where many subjects can be integrated and also that it benefits the students by enabling more hands-on teaching and relating it to their everyday lives. (Knobloch, Ball et al. 2007) In fact it is an important argument in the promotion of more hands-on, outdoor and authentic pedagogy in the Danish educational and political debate. However, the study by Knobloch, Ball and Allen (2007) found that teachers need more knowledge and access to resources and themes relevant for connecting the teaching to students' lives (Knobloch, Ball et al. 2007).

Trexler and Hikawa's qualitative study from Michigan USA involving teachers in developing a curriculum related to food, agriculture, renewable resources and environment (FARE), showed that they lack experience in curriculum development, as well as time, materials, literature and other resources. (Trexler, Hikawa 2001) Other studies like Trexler et al (2000) also found that teachers request more curricula and other educational resources to enable them to teach about agriculture and the agri-food system (Trexler, Johnson et al. 2000).

Trexler et al (2000) also touch upon the interest and barriers identified by teachers related to farm visits and other hands-on and experiential learning methods. This showed that many teachers find these alternative teaching methods to be impractical due to financial constraints in the schools. But they also mentioned cold weather, lack of greenhouses and limited travel funds as barriers, although they recognized that these teaching methods have benefits. (Trexler, Johnson et al. 2000)

As mentioned in section 3.2.2, the study by Trexler et al. (2000) also found that the focus of teachers in that study, when teaching about agricultural issues, is more linked to giving students an understanding of food and nutrition and how agriculture links to students' lives as consumers and health. An important value amongst the teachers related to teaching about agriculture was for children to understand where their food is coming from, which the teachers in the study report to be lacking. However, the promotion of an understanding of connections between humans, the food system and the environment in their teaching was not greatly emphasized. (Trexler, Johnson et al. 2000)

3.6. Outdoor learning and outdoor education research

The practice and benefits of farm-collaboration have several overlaps with outdoor education and is in fact a setting for outdoor education. The final area of this review is outdoor education research. Some of the findings on outdoor learning related to benefits of outdoor education, teachers' experiences and other factors are likely to be similar to farm visits and other outdoor on-farm activities. There is relatively more research conducted in Denmark on outdoor education - or as it is called in Danish "Udeskole" – than has been the case with farm-to-school programs, farm based education and school gardens. However, outdoor education is a recent phenomenon for which reason research on Udeskole is also quite limited. Some of the case schools presented in this Ph.D. project in fact incorporate broader outdoor learning activities in addition to the farm-related ones.

According to Bentsen, Jensen, Mygind and Randrup (2010) *Udeskole* in Denmark began as a voluntary bottom-up process by enthusiastic teachers. The Danish school system's tradition for bottom-up development and teachers' 'freedom of methods' has been conducive for this in terms of experimenting and developing various outdoor education activities. (Bentsen, Søndergaard Jensen et al. 2010) However, according Bentsen, Mygind and Randrup (2009) the practice of outdoor education in Denmark has been inspired by Norwegian, Swedish, British and German thoughts and ideas within sports, recreation and education. The definition of the Danish Udeskole concept is inspired by the concept of out-of-school teaching from Norway, which not only refers to a method of teaching but is a movement to redefine school and that education should be more closely linked to the social, economic, political and geographical context in which it exists. In practice this means, that teachers and pupils also use natural surroundings (forests) or cultural settings, i.e. farms, museums, companies, factories, churches etc. as 'outdoor' classrooms on a regular basis (i.e. a day every or every other week throughout the school year). (Bentsen, Mygind et al. 2009)[11] Udeskole is in this sense a more structured and frequent form of outdoor education, whereas outdoor education can be less structured and occasional than Udeskole.

In general, outdoor education research like the other areas of research covered already also focuses on the health benefits of taking the teaching outside of the classroom, especially looking at the benefits for physical activity and mental, emotional and social health. Another key benefit, which is documented in outdoor education research, is that educators perceive it to improve personal and social skills and empower the learners. Finally, an area of outdoor education research is the provision and teachers' practice and views as well as the various structural factors in the schools and elsewhere, which either promote or limit outdoor education practice.

Bentsen, Mygind and Randrup (2009) in a review of international research and development projects in Denmark found that Udeskole can add value to normal classroom teaching especially highlighting the health and social and well-being benefits (Bentsen, Mygind et al. 2009). Results from a Danish study by Mygind (2007) using an accelerometer to measure physical activity levels

[11] Inspired by Jordet 2007 and 1998

showed that an outdoor learning day more than doubled the mean activity level compared with a traditional school day (Mygind 2007). In a later study by Mygind, (2009) a project was studied from a social and psychological perspective using questionnaires completed by the students over a three year period (2000-2003). The study concluded that the combination of classroom and outdoor teaching had a positive effect on the children's social relations, experience with teaching and self-perceived physical activity level. (Mygind 2009)

In a qualitative study of teachers and school principals from Australia, Maller (2009) looked at the perceived benefits of outdoor education. The study showed, that according to the educators in the study, the hands-on activities and contact with nature at a crucial time in the children's development can improve children's self-esteem, engagement in school and provide them with a sense of empowerment. Referring to ecological and educational theorist,[iv] Maller (2009) links his findings to the notion that nature is important for children in promoting imagination and creativity, cognitive as well as intellectual development and enhancing social relationships. Furthermore, it is suggested that time in nature facilitates;

"Children's understanding of their place in the world, their knowledge of nature, and develops their cognitive, emotional and spiritual connections to the social and biophysical world around them." (Maller 2009) (p. 523)

Based on the evidence from Danish and international research, Bentsen, Mygind and Randrup (2009) concluded that Udeskole can contribute to realizing the overall aims of the Danish school system, especially referring to its aims related to health, well-being and social competencies. It can contribute to academic, social, personal and physical education and development, and can add value and variation to daily school life. Bentsen, Mygind and Randrup (2009) stress that outdoor education and mainstream classroom teaching should work together and complement each other. (Bentsen, Mygind et al. 2009)

In terms of the provision or prevalence of outdoor education in Danish schools, Bentsen, Jensen, Mygind and Randrup (2010) based their study on Danish Udeskole on a national population survey involving all 2082 Danish schools with a 52% response rate, documenting the extent of Udeskole activities, dissemination of Udeskole and barriers to teaching. Findings of that study showed that 28% of the responding schools practiced Udeskole and another 15% planned to start Udeskole within the next three years. The barriers and opportunities to Udeskole in Denmark were identified. One of most important barriers was economic ones, which included costs and transportation as well as the need to bring an extra teacher and that the teachers needed training in outdoor teaching. A second group of barriers were cultural barriers related to the mainstream school tradition and mentality, which included lack of knowledge about Udeskole, non-flexible timetables and crowded curriculum. In terms of the opportunities for expanding the Udeskole concept (including school gardening and farming), it was found that school managers perceive very few barriers of high magnitude, and that safety unlike in some countries, was not perceived as a major barrier. The study

therefore concluded that Udeskole plays an increasingly important role in the Danish school system, and can also constitute a potential for green space management. (Bentsen, Søndergaard Jensen et al. 2010) Since the 2010 study, the reform of the Danish school system in 2013 has outdoor education (including farm visits and community collaboration and school gardens etc.) as an important principle in the reform. (See chapter 5).

3.7. Discussion

The review shows that outdoor-, garden- and farm-based education have a number of benefits for children ranging from improved health and nutrition, nature appreciation and environmental understanding, to academic learning, improved interest in and motivation for school in general amongst students and in science specifically. Furthermore, it holds potentials for broader personal development. This can be referred to as life skills, including social skills (inter-personal skills and the ability to work in groups), connectedness to the world around them and development of children's self-esteem and sense of empowerment.

The underlying rationales and discourse and related research tend to be that garden- or farm based learning has a number of benefits beyond the actual gardening skills or agricultural literacy, which the programs aim to foster. This is about the garden - or farm experiences being a means of exposing children to nature, to the source of their food and a practical outdoor learning environment. One of the discourses is that it can cultivate healthier eating habits, which the majority of studies focus on. Other discourses are about garden-based learning fostering more environmentally-friendly eating habits, connectedness to nature and pro-environmental behaviour as well as motivation to learn, strengthening academic skills and promoting self-development and empowerment. The garden or farm experiences are in other words closely tied to a whole range of broader goals and ideals, which go far beyond the actual farm and gardening activities and skills. The majority of existing research is on nutrition and health promotion, whereas there is still limited research on the numerous other apparent benefits of garden- and farm-based education. Although not always explicitly mentioned in the programs and research, the fostering of habits, learning, competencies and values for the future is inherent in most of these programs, whether the main focus is on nutrition or health promotion, environmental understanding or life skills.

What characterizes the research reviewed here is that it is a mix of quantitative or mixed methods short-term intervention- and evaluation studies on the one hand and on the other more qualitative and case-based research on the perceptions of children's learning and experiences by teachers with various types of activities away from the classroom. Some of the studies focus directly on the impact on students, others more indirectly through the experiences of the teachers, or looking at the prerequisites of the teachers of working with food and agriculture. The rationale of my research is to contribute with more knowledge to the field of food literacy and its link to farm-school collaboration from the teachers' and farmers' perspective, which so far is largely missing. Looking into the motivation, values, learning goals and methods used by farmers and teachers can not only give an insight into what motivates these stakeholders in order to expand such collaboration to other

schools. It can also be used as a foundation for developing the field further and making recommendations for the future in terms of the curriculum. The motivation, values, learning goals and methods of teachers and farmers working with the students are likely to have an impact on how and what students learn in the short-term, although there is naturally a difference between intended learning and actual learning. Although it is not possible to study the long-term impact, understanding the underlying learning goals, teaching methods and integration back at the school is likely to give some indication as to the possible broader and long-term impact.

Chapter 4 Case study findings from Denmark: motivation and collaboration arrangements

This chapter will present the empirical findings related to the different collaboration arrangements between farmers, teachers and other stakeholders, which the four case studies represent. Based on interviews and observations, I will describe the stakeholders' objectives and motivation behind the collaboration as well as the identified challenges and opportunities related to the farm-school collaboration.

4.1. Background on farm visits and food and agriculture education in Denmark

Farm visits for school children are not a new phenomenon: farmers across Denmark have opened their farms to visitors for decades. Farmers have typically welcomed visitors to their farms, especially students, informally and often without any financial compensation.

Farm visits, however, have become more organized and linked more to the curriculum in the Danish schools in recent years; with more of an educational content relevant for integration into the curriculum in different subjects and at different grade levels in the Danish schools, increasingly with the provision of a financial compensation for the farmer's time. Apart from some teachers' own collection of educational resources especially from the internet and various knowledge centres for learning materials, two of the key food and agriculture interest organizations in Denmark have developed and distributed their own educational materials to be used in connection with a farm visit. They have been developed to be used before, during and after the farm visit to ensure optimal learning and academic relevance.

The two key players in promoting and supporting farm visits amongst schools are the Danish Agriculture and Food Council (DAFC) and the Organics Denmark (OD), both interest organizations of farmers and food industries. This chapter will present the results from interviews and observations with farmers, teachers and representatives from DAFC, OD and the producers' association for organic schoolyards. The main focus is on presenting the four cases and findings related to the collaboration arrangements in each case. Secondly the motivation of respectively the farmers, teachers and interest organizations for engaging in farm visits and food and agriculture education will be presented. At the end of the chapter, the main challenges and opportunities for farm-school collaboration identified by the stakeholders will be presented and discussed.

The Danish Agriculture and Food Council (DAFC)

DAFC, an interest organisation representing farming and food industries of Denmark including businesses, trade and farmers' associations, was established in 2009 after a consolidation of the former Danish Food and Agriculture Council, Danish Slaughterhouses, Danish Pork Producers, Danish Poultry Producers, Danish Agriculture (including Danish Agriculture Media, Danish

Agricultural Extension) and others including parts of the Dairy Association.[v] Prior to the merger in 2009, these different organizations had their own staff and sector-oriented educational materials. Some of these educational materials are still found in schools and available through DAFC.

After the consolidation, the former educational units of the different organizations were reduced to only one service with three full-time employees in DAFC. Since then, several new, printed and on-line educational materials have been developed in collaboration with educational experts, which increasingly but not entirely move beyond the past sector-oriented focus. Yet, the school service does still have materials e.g. focusing on cows/milk production and pigs/pork production, i.e. a sector orientation. The new materials include hands-on activities and are adapted to different grade levels, with didactic considerations and links to the educational goals defined by the Ministry of Children and Education for subjects like science, mathematics and Danish.

DAFC supports farmers in opening up their farms to visitors from schools by compensating each farmer with 500 DKR (nearly EUR 70) per visit, as a compensation for the farmer's time.

In the past three schools years, approximately 12,000 students were registered to have visited Danish farm. Being only half way into the school year 2013/14 and already 9795 students, it is likely that the number will increase beyond the 12,000 students. An unknown percentage of farm visits, however, are unregistered: some are done informally without payment or connection to the DAFC. DAFC has approximately 350 participating farmers across Denmark, about 215 are part of an educational program with materials developed by the DAFC's program called *The Class in the Stable* (in Danish "Klassen i Stalden"), which includes on-farm posters and workstations that can be used during the farm visit to make the farm visit more interactive, student-driven, investigative and less of a tour around the farm. Different investigations by the students themselves and practical excercises targetting both knowledge about the farm and agriculture as well as excersise to integrate math, Danish, science, biology and other subjects, are part of the activities.

Table 7: Number of schoolchildren visiting farms in Denmark

School year	**Number of students visiting farms**
2010/2011	12.888
2011/2012	12.017
2012/2013	12.199
2013/2014	9.795[vi]

Source: DAFC

As the figure 5 shows, there are notable regional differences when it comes to registered farm visits, which is based on registered financial compensation to farmers. According to DAFC, farmers on Sealand close to the capital area are keen to get the financial compensation for their work, whereas it is presumed that there is a large number of unregistered farm visits in rural areas located far from city centres, e.g. in Northern Jutland and Funen, due to the fact that farmers take in classes for free.

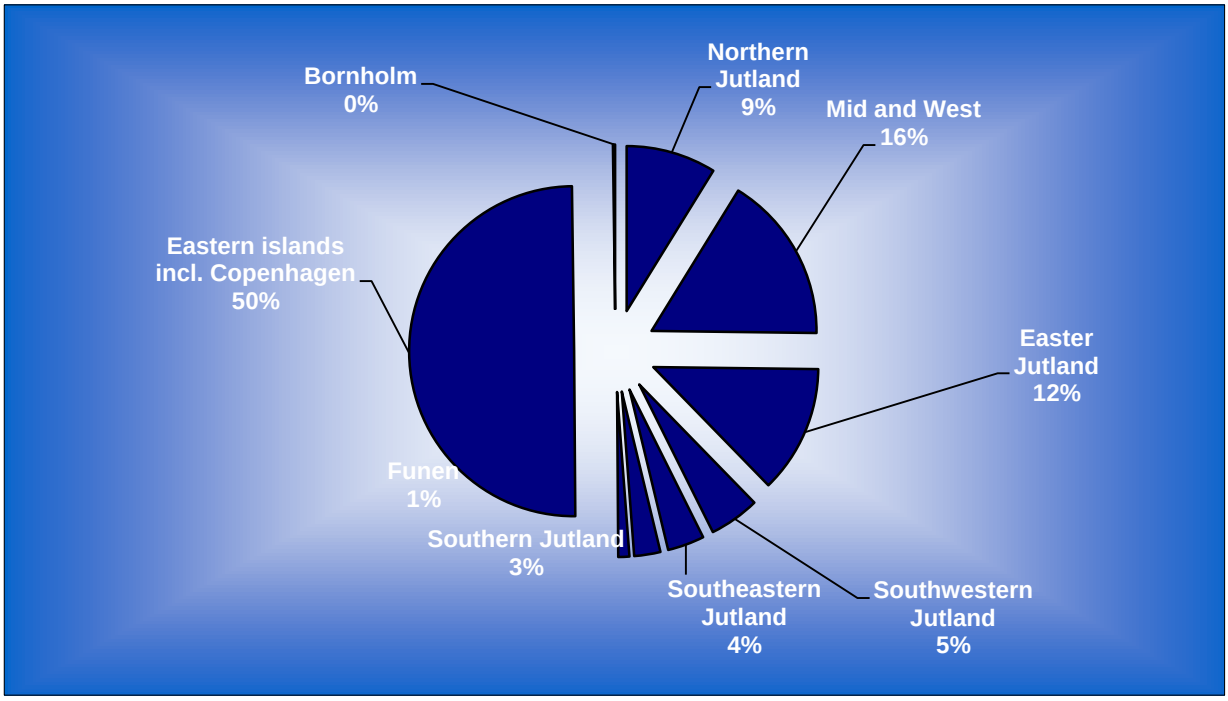

Figure 3: Total number of registered farm visits in Denmark. DAFC, 2011-2012

Photo 3: Map of DAFC school farms in Denmark. Source: ***http://skole.lf.dk/Book.aspx***

According to DAFC staff and the map above[vii], farmers in Northern and Western Jutland are especially active but do not frequently register the visits or expect a financial compensation. A possible explanation for these trends is that there are a greater number of urban schools inquiring about farm visits in the capital area and have access to public transport to get to the farm, for which reason farmers can actually make an additional income. In more remote areas of the country, the visits are more sporadic due to public transport limitations and farmers might therefore not count the fee as any notable income. Hiring a private bus is generally too expensive. Furthermore, many farmers here view taking in school classes as a moral obligation very dear to their heart, according to the staff working with farmers on DAFC's school program. These regional differences are well illustrated in figure 5 showing that the majority of registered farm visits are in the Eastern island region (Sealand and other islands) located close to the capital of Copenhagen, although most farms are found in Northern and Western Jutland. Eastern Jutland with the 15% of all visits, just like the Eastern Islands and Capital with 46% of all registered visits, is located close to urban centres.

The farms available for visits include pig, cattle, dairy, mink and other production types as well as both conventional and organic farms. The DAFC website also includes links to a smaller number of processing companies including dairies, slaughterhouses and others that offer tours to their production sites. These were, however, not investigated, as none of the teachers mentioned going to a processing company.

Organics Denmark (OD) and the Producers' Association for Organic Schoolyards

OD, representing organic farmers, businesses and consumers, initiated a program for visits to organic farms across Denmark. This included the development of educational resources to be used in connection with the farm visits. Since late 2010, however, OD has stopped funding the Organic Schoolyard program, which is now run by an organic producers' association. The Organic Schoolyard program of the producers' association is part of a program called Organics in the School. This includes farm visits, educational materials on organic food and organic school food (see: okologiiskolen.dk) There are currently 35 so-called 'organic schoolyards' in the producers' association in 2013 up from 30 in 2011. Since OD stopped fundig this intiative, the Producers' Association for Organic Schoolyards[12] has taken over the responsbility for e.g. seeking funding. All the participating organic farmers are, however, still members of OD.

Organic schoolyards are organic farms that take in classes for farm visits. The producers' association for Organic Schoolyards was initiated after a pilot project in 2010. The project was initially a collaboration between the association and Coop Denmark [viii] to spread awareness of ecology and organic farming amongst children and youth through Organic Schoolyards. In 2010, funds were available through Coop Denmark to reimburse the then 30 farms participating for their time. In connection with this initiative, it was decided to initiate a pilot project called Organic Network Eastern Jutland, where local farmers participated in the Organic Schoolyard initiative as well as local shops, elected local Coop representatives and teachers in local schools. The goal of the pilot project was to strengthen the local Coop shop councils and enhance the academic output from school visits to farms. One of the overarching objectives of this collaboration was to foster a 'sense of coherence' between the different stakeholders, to reconnect them to the local area, which many people are becoming more and more detached from. (Ruge 2012)

Additional funds provided from local Coop shops were designated for materials in the classroom such as food and presentation materials as part of the thematic projects on organic food and farming. The funding neither for these materials nor for the Organic Schoolyards was permanent and the funding from Coop Denmark ended in 2011. From the beginning of 2012, the project has been transferred to the producers' association, who applies for continued funding for the activities. According to the head of the association, some funds were left from 2011 due to unspent funds, because the interest and knowledge about farm visits by teachers is still limited and transport time and costs to some farms are limiting factors.

Thus, unlike the DAFC farm visits, the funding for compensating farmers for their time, is not permanent but based on short-term funds available through various sources. For this reason, the number of visiting students vary from year to year depending on the availability of funds as illustrated in table 8. Apart from collaboration on funding, the Organic Schoolyard farmers (organized in the producers' association) meet to exchange experiences.

[12] From now on either referred to as organic producers' association or Producers' Association for Organic Schoolyards.

Table 8: Number of schoolchildren visiting organic farms in Denmark

Year	Number of schoolchildren visiting farms
2010	2000
2011	3075
2012	3500

Source: OD. (Ministeriet for fødevarer, landbrug og fiskeri 2011, Ruge, Økologisk Landsforening 2011)(Producers' association for Organic Schoolyards, 2012).

Like the DAFC, the Organics in the School Program (under which the Organic Schoolyards program is placed) has a wide range of educational materials, including written materials, worksheets and movies available on-line, which can be used before, during and after the farm visit. Many of the educational materials were developed in 2008 in collaboration with an educational expert and have been developed to meet the needs of students at different grade levels, with didactic considerations and links to the educational goals for subjects like science, mathematics and Danish by the Ministry of Children and Education. Recently, the educational materials for 6^{th} to 10^{th} grades were updated to include topics related to nature on organic farms and materials and exercises that can be connected to QR codes on the students' smartphones.

Prior to the pilot project starting in 2010, a systematic review of experiences by farmers and teachers of farm visits was conducted (Breiting, Ruge 2006). The report concluded that there was a need for more academic content and relevance of the farm visits to get more teachers to take time out of a busy schedule to go on a farm visit. In order to achieve this objective of increasing the academic content and relevance, it was recommended that teachers work with agriculture and food production before and after the farm visit. (Breiting, Ruge 2006) In connection with the report on farmers' and teachers' experiences with farm visits, the online step-by-step and grade adapted educational materials were developed. DAFC's educational materials are also based on the importance of integrating the field visit in the teaching back in the classroom before and after.

Currently, there is limited documentation and research on farm-school collaboration in Denmark as well as the integration of farm visits in the curriculum. The aforementioned data on registered farm visits was collected for the first time for the school year 2010-2011 by both the DAFC and the OD (later the producers' association), for which reason there is no data available prior to 2010 for comparisons. This is partly due to the fact that much of the work on farm visits by DAFC prior to 2010 was more decentralized and that there was no focus on or need for gathering data to document the extent of farm visits in Denmark in the past.

4.2. Typologies of farm-school collaboration arrangements – four exemplary cases

Farm-school collaboration in Denmark can be grouped into five categories. *The most common* is one-day (half-day) farm visits with varying degrees of integration in the classroom, in e.g. different subjects (e.g. science, biology, home economics or mathematics) or as interdisciplinary projects (with themes such as "nutrion and physical activity", "farm-to-fork" or "organic farming"). *The second* is one-off excursions with limited focus on learning and more focus on the fam visit being social event. The third and fourth types are longer and more rare. They both enable children to follow the seasonal production cycle and be active on the farm e.g. by having a small plot similar to a school garden, where they can grow potatoes or other crops. In *the third type*, individuals or a group of teachers organize visits to a local farmer/farm organisation over a growing season. In *the fourth type*, schools, even municipalities, have a more long-term collaboration with a farm or school garden, and it is integrated into the curriculum over the growing season or over several school years. In both types of longer collaboration, it is common for students to be actively involved in some type of school garden/plot, often using this for different pratical experiments. This might also include cooking activities. Cooking is sometimes included in programs involving a single farm visit as well. Finally, *the fifth type* of collaboration is where farmers open their farm to a whole class or a few students for a week-long stay as sort of a farm stay or internship.

This study looks into four cases of farm-school collaboration and organization reflecting some but not all of the broader typologies described above.

4.2.1. Case study 1 – Single farm visit with pre- and post-classroom integration

The first is the most common model of collaboration: a conventional dairy farmer near Copenhagen is taking in urban and local rural schools on single farm visits. This is a family-run farm run by a part-time farmer with a part-time teaching job. The farm is located approximately 1.5 hours by public transport from Copenhagen. Due to relatively easy access (train and bus), the farm takes in on average 50-60 visits per year and up to 80, in other words up to more weekly visits. The farm is a conventional dairy farm with 95 cows supplying milk to the dairy company Arla Lærkevang® in addition to 100 calves and young cows. The family owns 175 hectares of land and grows grass, corn, wheat and beets for fodder, ensuring that they are self-sufficient. The main educator on the farm is the wife, who, with her background as a teacher, has experience in teaching and using the farm as an outdoor classroom. The farmer explicitly says that she will not take in classes, who are just there to get a tour and a day off without any educational content.

During the observation on the farm and interviews with teachers and pupils, the work stations and posters from DAFC were not used. One reason could be that the farmer is not used to working with the posters and workstations and conducts the farm visit based on habit and previous experience. This was mentioned by staff at DAFC's School in Agriculture as a problem: many farmers do not see the use of the work stations etc., and prefer to do the farm visit as a tour the way they have always done. However, another reason in this case for not using the materials and activities could be that the teacher simply wanted a tour around the farm, where the farmer is the expert or authentic

teacher showing the pupils around. Normally before the visits, the farmer and teacher talk over the phone to discuss expectations and how and if the visit should be integrated within specific subjects. On the website of the farm, it is stated that it is possible to integrate the visit with outdoor real-life math excersises: e.g. calculating how much milk 100 cows supply per day and during a whole year. This was presumably not included in this case, because the class had already done a similar exercise at a field trip to the zoo.

The case schools: the urban public school and rural private school

In the investigation of how the farmer works with schools and teachers, two types of schools/classes, educational level and methods of integration in the teaching were selected to get different perpspectives on how the farm visits are used and integrated. The first one was the 3rd grade in an urban public school in Copenhagen mentioned before. The second were students from 8th and 9th grades at a private school in a village in the countryside in rural Sealand.

The urban school

The 3rd grade came from an urban school with children from mixed backgrounds. There are many different nationalities in the school and a large percentage of bilingual (nearly 50%) but also Danish children. The school was transformed in 2007 into one of the first sports schools in the country, based on the basic idea that exercise, play, health and social interaction should be overarching principles of the school life.

The farm visit was conducted in a traditional way: a tour around the farm including the stables, looking at calves and young cows as well as dairy cows. During the visit, the students were shown around to see the different stages of the cow's life and also the different processes and conditions under which the cows live, including seeing the milking station and fodder, most of which are produced on the farm. The children were allowed to pet the cows, let the cows lick them, feed them and the farmer tied up a few of the students in the stable briefly to pretend they were cows, all of which they were very fascinated by. The students were eager to ask questions and the farmer also asked them questions, which revealed that some of the students already knew a little about cows and farming from the classroom or home countries.

The farm visit was part of a longer interdisciplinary theme about animals, which the teacher integrated in science and mathematics. The teacher also took the pupils to a zoo, where they got a chance to measure fodder and estimate how much milk a cow can produce.

Following the theme on cows, they went to an outdoor school/nature reserve where they studied sheep. The students also went to a viking village to live like and learn about the stone ages, and how agriculture and animal husbandry started in the stone ages. The previous year, the teacher organized a longer teaching program in science where she took the pupils to a school garden to learn about the growing cycle.

The teacher teaches Danish, science, history, mathematics and religion to the 3rd grade as well as

German to 7th and 9th graders. The fact that she teaches many subjects to the same class enables her to integrate different subjects and be more flexible with the weekly schedule to allow time to take the students on out-of-school events, which require transportation time. Going to the farm took approximately 1.5 hours one-way. Although the school is a so-called "sports school", it is not widely practiced at the school to do out-of-school activities. The teacher has been on a course on outdoor pedagogy organized by the Municipality of Copenhagen along with a few other teachers from the school. However, as far as she was aware other teachers at the school do not do activities like farm visits, school gardens and similar activities. According to the teacher, it is her own initiative entirely and the school management does not support the out-of-school activities actively. The teacher often brings parents along, when she goes on a trip. However, during the farm visit, she brought another teacher and a parent to help watch the children during the visit and going to and from the farm.

The rural school

The rural school is a private school or in Danish '*friskole'*. The 95-year-old parent-driven school has a long history in the Grundtvigian tradition with strong ideals. This means that the values of the school, according to the school's website, are based on recognizing children's way of learning and experiencing the world; not only focusing on integrating hearing and vision in the teaching, but also using other senses. The pupils are challenged academically and personally and learn how to take responsibility. As a consequence of these principles, the school has no tests, but instead have many student-driven projects and experiential learning. The school focuses on story-telling, conversation, reflection and community within the school and with the surrounding community to provide students with skills relevant for an unpredictable future, as stated on the school's website. In working with science, the school aims to integrate natural science knowledge through investigation and verification as an important foundation for the knowledge of the pupils, while also encouraging them to reflect on their values, faith and being part of nature. Another overall goal of the school is to enable students to become democratic, critical citizens with knowledge of the world and their own life providing them with tools for changing the world in the direction they desire.

The educational program on food, agriculture and farm visits exemplifies well these ideals and how they are put into practice: the students in 8th and 9th grades did a group project on agriculture. The purpose was to identify a problem, develop a problem formulation and gather information through farm visits, interviews with farmers and information searches on the internet. The project started with a brainstorming process lead by students on topics, after which 11 groups were formed. Some of the selected topics were: pros and cons of organic and conventional farming, comparisons between Danish and African agriculture, future vision for agriculture, different views on protective agricultural zones, conditions for farmers, mink farming, animal welfare, medicine use in pork production and organic food and environment. Apart from working on a problem formulation, the groups were asked to write a logbook throughout the process, a conclusion and present their results during an agricultural fair for other students at the school. Part of the task of presenting their project work to the rest of the school, was to learn how to communicate to an audience and adapt their communication to fit the audience (of younger pupils). The groups presented in various creative

ways; doing oral presentations, debates, dressing up as farmers, exhibits, taste samples, posters, short movies including a group who made their own movie, some of which worked better than others on their young audience.

The collaboration model

The collaboration model can be characterized as a loose, informal and open system network in terms of the collaboration between farmers and teachers. There is a semi-formal collaboration, however, between DAFC and farmers of providing the farmers with compensation for their time spent with school classes. DAFC also provides farmers with support and advice in terms of teaching materials (posters) for the farm and in providing teachers with materials and preparation materials. DAFC has a website with information about farms to visit and educational resources, which teachers can access. Arla Lærkevang/Arla Foods provides their own educational materials accessible also through DAFC's website as well as cream shakers and milk, which farmers can distribute during the visits by schools. Usually the relation between the farmer and teacher is rather brief, and primarily to prepare and conduct the farm visit. In some cases, however, the same teacher or group of teachers returns to the same far year after year.

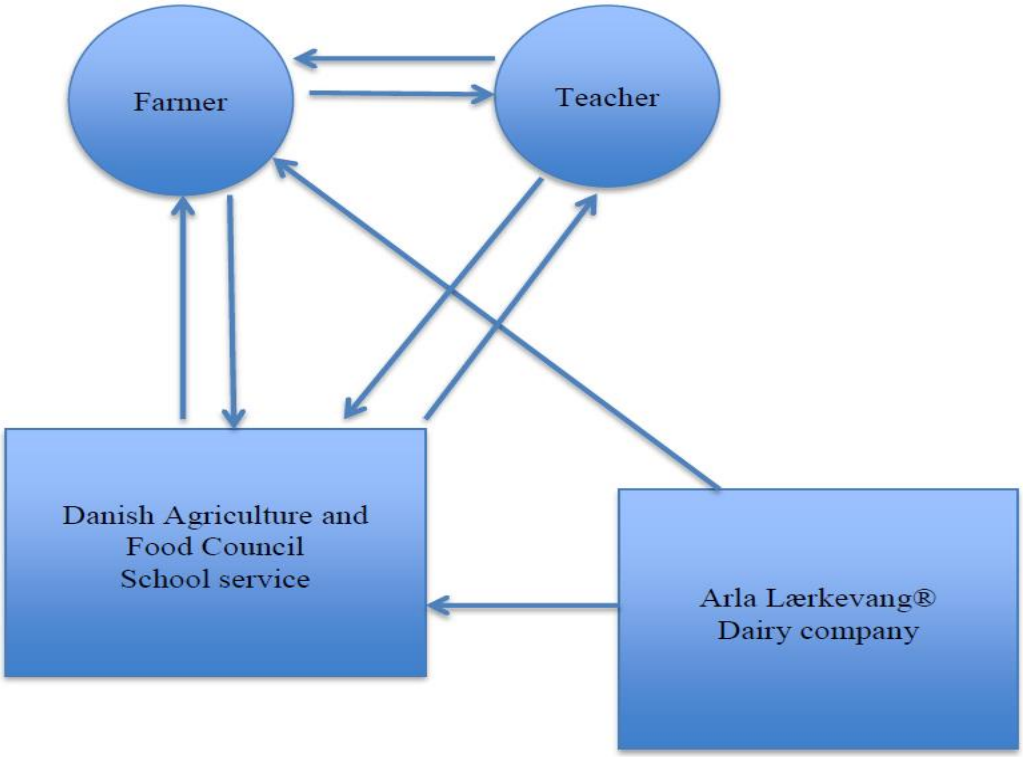

Figure 4: Farm-school collaboration model 1

4.2.2. Case study 2 – Multiple visits and organic farmer collaboration

The second case is a network of organic farmers mentioned in 4.1., who cooperate across the country to promote organic schoolyards, exchange information amongst participating farmers and seek funding for the visits. The case includes interviews and observations of collaboration between a family-run organic meat farm and a cooperative with their own integrated plant and livestock production in a rural community just outside a major city in Denmark. The collaboration and funding available has enabled schools in the local community and in the city to go on several visits to the organic cooperative as well as a visit to the organic meat farm. In the cooperative, the schoolchildren have been engaged in cooking activities and growing their own vegetables in a small school garden plot on the land of the cooperative.

The organic family-run beef farm

The farm has been organic since 1997. Apart from 12 mother cows and their calves, the farm has horses and is self-sufficient with fodder. In addition to the stable and fields around the farm, there is a small pond, bird life, insects and frogs around the pond. The farm is family-run, run part-time by the wife, who has a background as a teacher and is also head of the organic producers' association working to promote organic schoolyards i.e. farm visits. She offers half day tours around the farm including information about ecology, organic farming, different cattle, the fields, nature and the pond. A typical tour around the farm costs DKR 500 (EUR 70). Classes, who are working with the educational materials from the Organics in the School program, can go on the farm visit for free when funding is available to cover this cost. Apart from a regular tour around the farm, the classes who have worked with the educational materials can do different exercises e.g. related to the nature around the farm.

The organic integrated farm and living cooperative

The cooperative is a community focusing on living experimentation and sharing of knowledge about ecology and sustainable development. It includes practical living arrangements and is a community, where housing, agriculture, energy production, social development, culture, consumption, food, waste handling and financial aspects are all based on sustainability principles. An important part of the objectives of the cooperative is to actively communicate these principles to the local community including the local school and others, e.g. schools and interested consumers in city located 14 km from the community. For this reason, the three people involved in the community's agricultural production also gladly welcome visits from schools and kindergartens. One of them is a trained farmer. The other two are respectively a teacher and an energy planner. Their involvement in the visits from the schools depends on their availability and other employment obligations. Especially the teacher has flexibility to spend more time working with the schoolchildren. As opposed to the organic beef farm, the cooperative has land available and prioritizes longer educational collaboration with the schools, which involve setting up a school garden in the cooperative, where classes can come and participate in farm activities over an entire growing season. Both schools mentioned below have used this as an opportunity to integrate the visits into a longer educational program in the school about organic agriculture, consumption and science. The local school and other schools from the city also use the cooperative to learn about

sustainable living and sustainable development with the many practical and living examples of how this is done in the cooperative.

The farm visits by the schools were organized in different ways depending on the needs of the teachers and closeness to the farms. Here are the two classes studied.

The local school
A local school participated in a closer collaboration with the cooperative especially the 3rd grade (later 4th grade), who had a school garden in the cooperative over two growing seasons, where they went once per week. This allowed the children to follow the process of growing food from seed to table. The class also went on a more traditional farm visit to the organic beef farm. The main focus of the teacher was to promote social learning and cohesion in the class, who experienced challenges with individuals and group dynamics. The farm visits and gardening, however, were also integrated into science by the science teacher. The whole school also used other visits to the community in a thematic week on sustainability and sustainable development, integrating perspectives on waste, consumption, food and energy issues from the community.

The urban school
A 6th and later 7th grade from a private school in the city visited the cooperative three times over the growing season to do a field experiment with potatoes for a project in their science class. The project was to learn about ecology, organic farming principles, nutrient cycles and photosynthesis and other complex processes and concepts integrating theory and practice. Potatoes were used as an example for working with various complex issues. In collaboration with two more teachers, the science teacher organized experiments where students e.g. grew their own potatoes while conducting experiments with the effects of fertilizer application and non-application on potato yield. In addition, the students did a supermarket visit to identify nutrients in potatoes from reading product labels and used potatoes to learn about enzymes and glucose molecular models. In addition to these science experiments and perspectives, the teaching and field visits also included cooking with potatoes and learning about food safety/hygiene aspects. Finally, the teacher included perspectives related to his students' forming their own opinions about agriculture: discussing and forming opinions about organic and conventional agriculture based on field experiences on the organic farm and talks with the farmer, films about conventional agriculture and other information and discussion on the teaching about organic and non-organic agriculture. Although they did not have time to visit a conventional farm, the teacher used short films from YouTube to teach about conventional agriculture. Led by the science teacher, several other teachers were also involved in the visit to the cooperative and classroom teaching.

In addition to the classes mentioned above, classes from two other schools also visited the farms as part of the project. In the pilot project, with funding from Coop Denmark, additional funds from the local Coop shops were designated to be spent on materials in the class such as food and presentation materials as part of the thematic projects on organic food and farming.

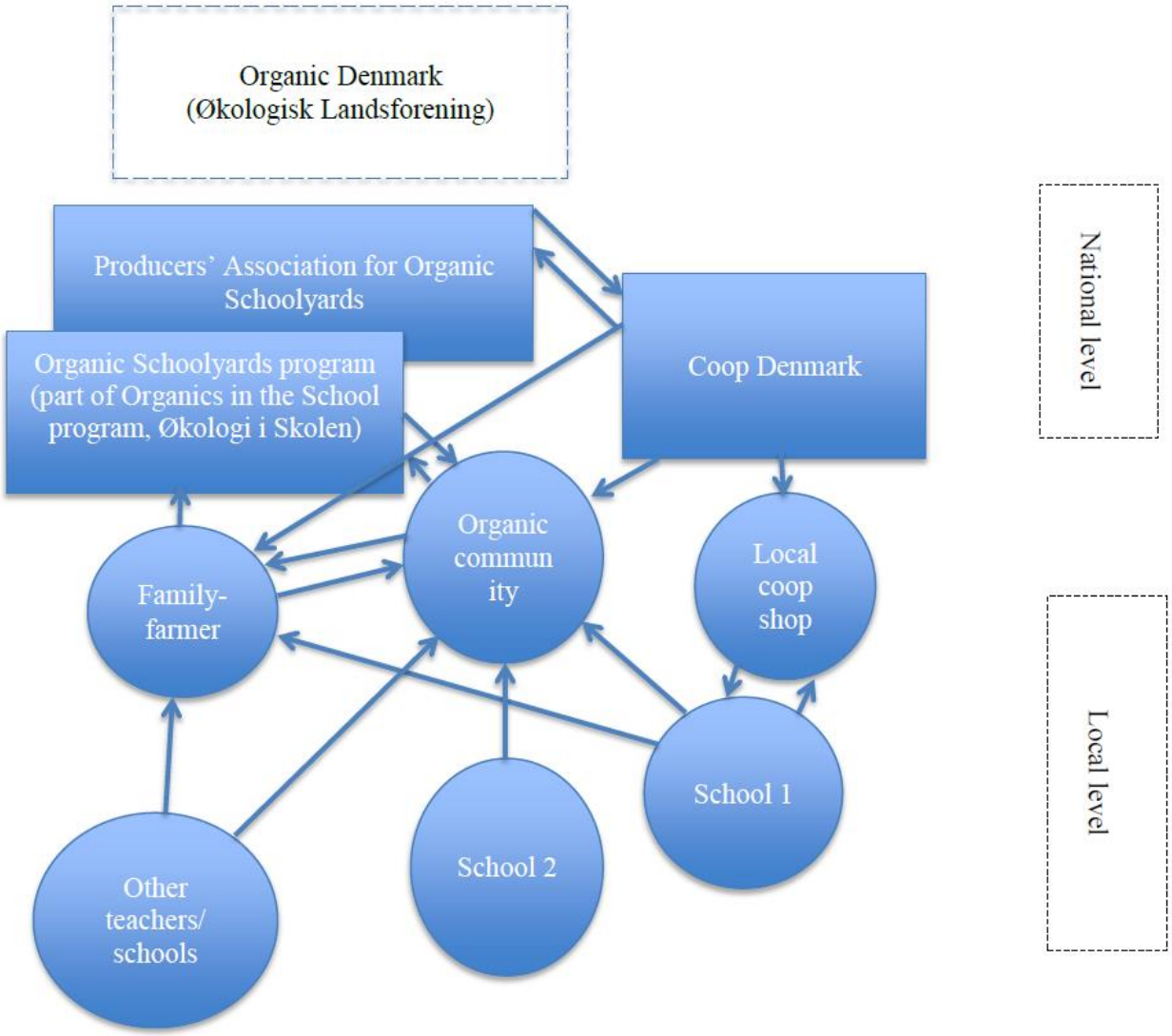

Figure 5: Farm-school collaboration model 2

The collaboration model

This model includes more stakeholders and stronger collaboration than in case study 1. This is based relatively locally with a longer-term collaboration: a collaboration respectively between 1) the family farmer and schools (here only the two schools in the case study are illustrated but there are more schools/teachers participating in the program), 2) schools and the organic community, 3) the school, family farm and organic community, and 4) between the two types of farms partly under the organic producers' association. Coop Denmark and the local branch have supported some of the schools with funds. But the primary connection to stakeholders outside the local community is through the producers' association, who has is now in charge of the Organic Schoolyards and educational materials. As a result of this educational program and materials, the organic producers

at national level have joined forces to seek funding for farm visits and the development of educational materials nationally.

4.2.3. Case study 3 – Science network and closer collaboration between several schools and stakeholders

The third case is a science network between three schools in and around a rural mid-sized town in the north eastern Jutland in collaboration with local farmers and a science centre and nature guide in the municipality. The DAFC supports the project with consultancy advice and education materials and a large supplier of fodder, grain, fertilisers and other agricultural inputs provides grain etc. for the different workshops. There is a close cooperation between the science teachers in the three schools, who receive expert advice from the farmer, nature guide, science staff and a plant consultant both in terms of putting together educational activities and content that is relevant for the educational goals for pupils in respectively 4th, 5th and 6th grades, but also for the progression and integration of teaching between the different grades: in other words building on what they have been taught in the previous grades. The experts also participate during the workshops, which many students are fascinated by, when e.g. getting the opportunity to ask questions to the farmer directly. After success and positive feedback from the pupils and teachers, the activities, which are primarily a series of workshops and subsequent classroom follow-up, have been extended and written into the annual teaching plans of the respective schools.

According to the farmer and teachers interviewed, the background of the science network dates back to a science initiative by the municipality starting in 2004. Since the beginning the three schools have collaborated on planning joint science projects together with the science centre and Grundfoss[ix]. The collaboration on agriculture started when a meeting was organized to kick-off a cooperation between schools and agricultural stakeholders in the municipality within an overall framework of promoting the science profile of the schools and the municipality.

Teachers from all the schools in the municipality were invited to a conference at the science centre with participation and presentations by a number of farmers as well as experts within animal husbandry, agronomy, food and other similar areas. Afterwards the different schools were grouped geographically and later joined by a farmer and other stakeholders. Meetings were organized and the network started materializing. The core group of the network is comprised of a coordinator, which is a teacher from one of the schools, science teachers in the three schools, a farmer and staff at the science centre. The network has also drawn on support especially technical or content advice from various experts within agriculture and science. Other schools from across the municipality participated in the start-off meeting. However, only this network has formalized their collaboration into an on-going programme across all the 4th, 5th and 6th grades in the three schools.

The science centre was established due to the low interest in natural sciences amongst children and youth, and the fact that there are too few young people getting an education within the natural sciences and technical areas in Denmark. Due to concerns that less and less young people take

interest and an education in natural sciences, the science centre was established with the purpose of developing natural science education to increase the interest amongst young people for future education and career choices in natural sciences. The agricultural theme within the science network is an example of this focus, trying to spark children's interest in natural sciences.

The activities with the different grades include the following:

- In the 4th grade, the students attend a workshop, where they experiment with planting potatoes, wheat and corn on a field near the science centre and one of the schools, with assistance from the farmer, his tractor and a plant production consultant. The children learn about different varieties of grain, food quality and health, do sensory experiments and take-home experiments on growing potatoes from potato peel and applying different amounts of water on wheat, which they can follow up on in the classroom. After the workshop, the students water and weed their field.
- In 5th grade, the same students harvest their crops in the fall. In addition to that they attend a harvest event in a forest, where they pick wild foods with guidance from a nature guide, cook their corn and potatoes and include wild plants and berries in their cooking. They learn how people ground flour in the old days and how to make butter from cream.
- The 6th grade students also have a whole day event in early spring where they do experiments with soil. They estimate the content of nitrate, lime and the pH value in the soil. They do experiments with the effect of respectively over- fertilizing and under-fertilizing the soil and applying adequate amounts.

The network relies on very committed coordinator, Morten, who according to both the other teachers and partners at the science centre plays a key role as the head of the steering committee of the network. He is the person with contact to external partners such as the farmer and consultants in DAFC. He not only handles the coordination between internal and external partners, but he is also the one calling for meetings, setting the agenda and taking minutes and in charge of the overall one with the big picture during workshops. The other partners (teachers, consultants, nature guides etc.) come up with ideas for the different activities during the workshops. According to the teachers, the professionals play a key role in assessing the academic relevance of the content and learning goals. The ideas and the overall purpose of the program is what the teachers have developed together with technical assistance from the partners. However, many of the interviewees expressed the central role of the coordinator. None of the other teachers have the time or the motivation to coordinate the activities. The coordinator, Morten, teaches biology in 7th grade and up in one of the schools. He does not teach the pupils participating in the network's event days and related teaching back in the school, but will teach some of them once they move up to 7th grade.

The activities of the network include multidisciplinary topics like agriculture, farm-to-table, food and nature/science, and are seen as an important foundation by the teachers to do further work with these areas in higher grades.

The collaboration between the science centre and DAFC's Agriculture and School consultants has been an important source of support in terms of getting educators and farmers involved. The DAFC's consultant has also played an important role in developing and accessing educational materials. A large agricultural input supplier DLG has supplied the workshops with seeds, fertilizers and other inputs like different grains to make the various experiments in and on a field near the science centre possible. The local farmers' association has also been involved in the network.

Working with the science centre has enabled the students (especially from two of the schools located close by) to take care of the field, which they have ploughed and sown with wheat, corn and potatoes. One of the schools is located 2 minutes' walk from the science centre and the other a bit further. The students in the third school have not been able to tend to the field on a frequent basis like the other schools; only the two to three times that the workshops have been organized. As a result, they do not have the same connection to the crops after they were harvested as the students from the other two schools. Due to transportation challenges and the way the program has been set up with workshops at respectively the science centre (workshop 1 and 2) and in a forest (workshop 3), the students from any of the schools have not yet had the opportunity to go on a farm visit to the farmer's own real life farm.

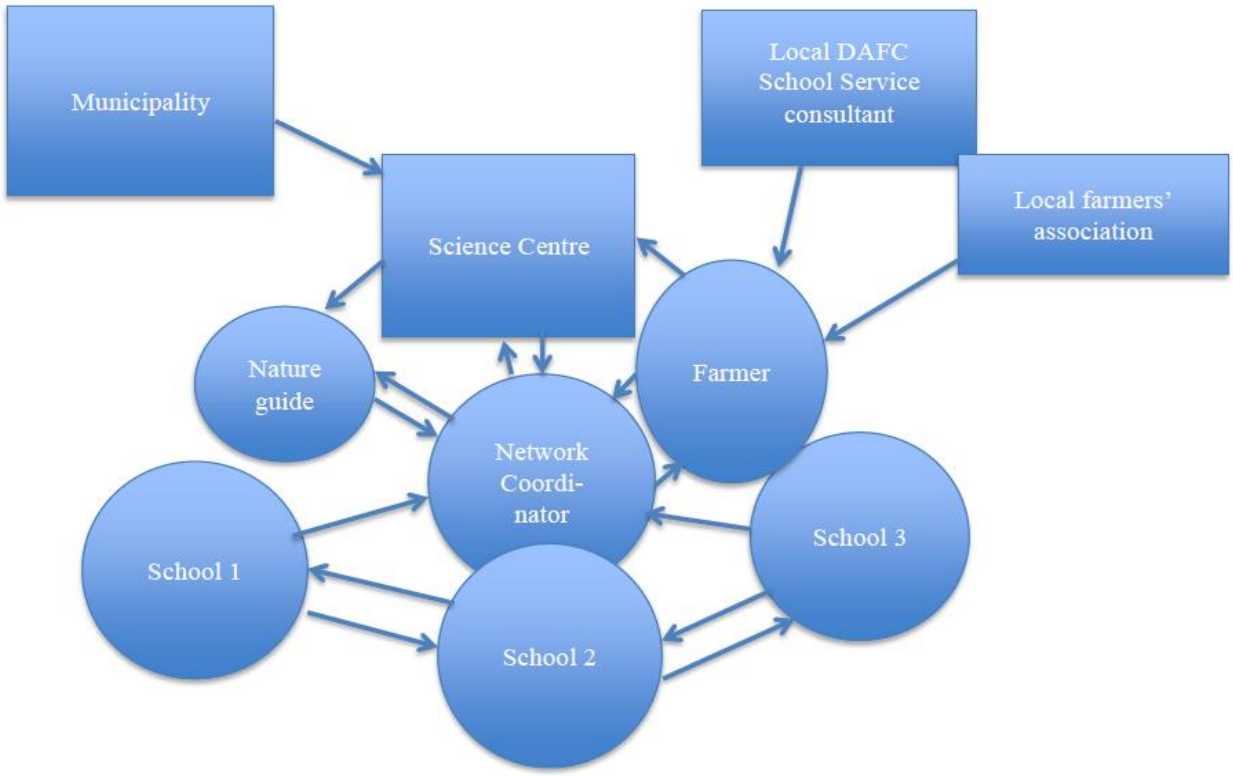

Figure 6: Farm-school collaboration model 3

The collaboration model

The collaboration is primarily based locally involving several stakeholders and multiple interactions between the stakeholders. The core of the collaboration is connected to the coordinator, who acts as a link between the different stakeholders. However, there are also interactions between the other stakeholder, e.g. when teachers exchange information and materials amongst each other. The coordinator is however the key person that facilitates the network activities. The science centre is also a key stakeholder for offering its expertise and a physical setting for the educational activities. Other stakeholders, like the municipality and DAFC have had a role to play in the initiation of the network activities, which, however, now have been taken over by the schools.

4.2.4. Case study 4 – Whole-school approach integrating food and agricultural education with cooking

The school is a public school located south of Copenhagen in an area with a high percentage of ethnic minorities and a school with a majority of bilingual pupils coming from families comprising of mostly adults with low level of education. In 2004-2005, the school was going through a crisis leading to the decision to restructure the school into a holistic school. Since then, the restructuring has led to many positive changes at the school. The school is not engaged in an ongoing collaboration with a farm or other external partners like with case study 2 and 3. The connection with a farm in this case school is similar to the schools in case study 1; a single visit to a farm and with integration into the teaching before and after.

There are, however, several reasons why this school has been chosen as a case:

1. The school is one of few schools in Denmark, who has so far been converted into a food school (madskole), which means that school meals are organic and prepared and sold at the school with the students participating in the cooking in the school canteen. It is rather unusual in Denmark to have food served and prepared at the school and especially by the students themselves. In the majority of schools, students bring their own packed lunches.

2. The school is "whole-day" school. In Denmark, it is common that the school day ends between 12 and 2 pm after which the children go to an afterschool club either at the school or at a nearby institution to play. In the whole-day schools, pupils have classes the whole day from 8 am to 3.30 pm., which means that the number of lessons during a week is higher than in most Danish schools. This model has inspired the Danish school reform, which means that all schools will have longer school days. It is holistic in the sense that there are opportunities of doing experiential teaching, e.g. in the school kitchen, school garden, excursion etc. outside of the classroom. The school has a permanent nature guide, who helps teachers use outdoor settings in their teaching. In addition, every Thursday, the school has 'professional skills days', where the teaching is integrated with professional skills, e.g. professional cooking. The objective is to strengthen the students' curiosity and motivation to learn when theory, practice, free time and play are integrated with academic and professional skills. This includes better opportunities to take students on farm visits and other

outdoor activities and engaging them in the cooking in the school kitchen. The school has a wide range of outdoor school activities available around the school. These outdoor learning activities are an integrated part of teaching and learning in all subjects at the school. All teaching has combined indoor and outdoor/practical activities and there are plans to establish a school garden at the school.

This also enables the teachers and students to make cross-disciplinary and theory-practice linkages between what they see and experience on the farm, do in the kitchen and elsewhere with what they learn in the classroom and in different subjects.

3. The school is one of the initial 13 so-called *"New Nordic Schools",* an initiative by the Minister of Children and Education to enhance the academic and life skills of children and youth in Denmark. It is about using the Nordic educational traditions and making connections between theory and practice though connections and perspectives to real life. This ties into the whole day and holistic school practice, which the school is practicing.

The school is an excellent example of how a school can work with a Whole School Approach integrating academic and educational aspects with the school practice of preparing and serving healthy organic food in the school kitchen, a school health policy, and outdoor practical and physical activities. In terms of working with both Education for Sustainable Development and fostering food literacy through the school, when looking at the school's goals, structure and practice, the school has some essential prerequisites for working with and realizing such overall goals.

The collaboration model

The final model is almost entirely based within the school; comprising 1) the school management, who has initiated the whole-school approach, 2) the teachers implementing it, some of whom collaborate with the staff in the school canteen, and 3) the nature guide, who supports teachers in terms of developing their teaching skills and methods in outdoor settings. There is not a close collaboration with the farm, but some of the teachers have been to a farm before, but do not have a closer collaboration with a particular farmer. There are plans at the school to start up a school garden on the school grounds with support by the nature guide working at the school.

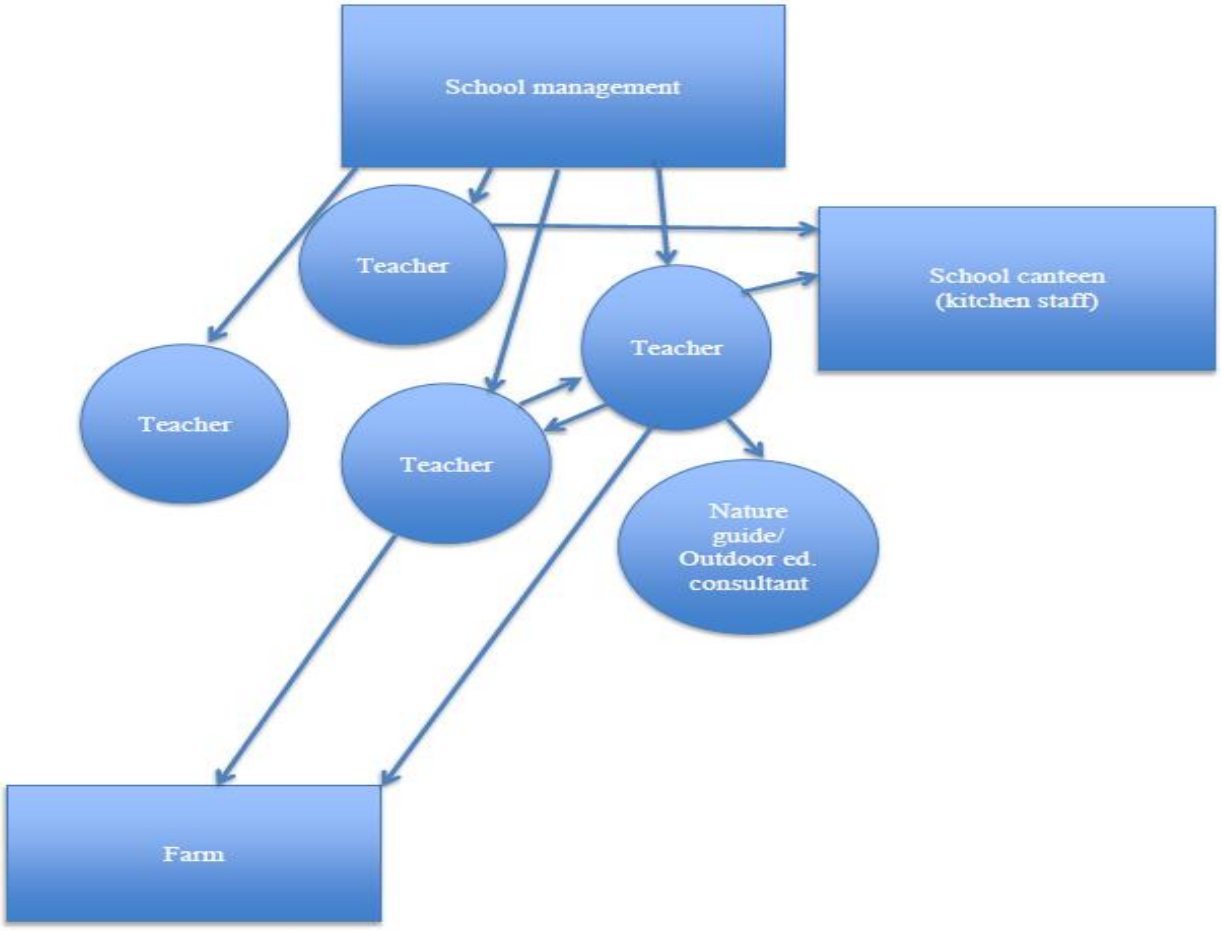

Figure 7: Farm-school collaboration model 4

4.3. Political perspectives for farm-school collaboration

There has been increasing political attention on improving the public schools in Denmark by the current and previous Government. OECD's PISA results and other evaluations have shed light on the following challenges, which are key points used in the political debate and the Government's school reform:

- 15 percent of all students do not have functional reading abilities when they leave 9th grade
- 17 percent do not have functional abilities in mathematics
- 17 percent do not have functional science competencies
- Many teachers have difficulties differentiating their teaching to adapt it to the abilities of different students. (OECD 2009, Ministeriet for Børn og Undervisning N/A, Danmarks evalueringsinstitut 2011)

Some of the key components of the school reform are to increase the number of weekly hours of school through - what was mentioned before - the holistic school and to use other more active and real life/out-of-classroom teaching methods. The Ministry of Children and Education urge schools to include more collaboration with local businesses, sports facilities, organization, school gardens and farms to enable and develop better and more relevant teaching methods. The objective is for the students to be able link theoretical knowledge from mathematics, science, biology, home economics etc. to more practical and relevant applications, e.g. building a small greenhouse integrating mathematics in the process, going to a school garden or on a wild food collection to gain practical experiences with food chains, photosynthesis and nutrition. Increasing physical activity is also an important objective. Related to meeting the challenges in regards to students' science, Danish and mathematics competences, the reform includes more teaching hours in these subjects as well as more hours for excursions and other experimental real life learning. The reform includes increased funding for research, management development and teachers' training in pedagogy and educational methods.

The Minister of Education has launched an initiative to enhance the academic and life skills of children and youth in Denmark using the Nordic educational traditions. This was also based on making stronger connections between theory and practice though connections and perspectives to real life and society. Under the aforementioned title "New Nordic School" initiative, a set of goals, a manifesto and dogmas were developed in 2012, which participating schools have to live up to. Many of the ideas and components behind the New Nordic School initiative are included in the school reform. (Ministeriet for Børn og Undervisning N/A)

The thinking behind this initiative and the reform includes a renewed focus on action orientation, exploration, connections to the community and world surrounding the school. The aim is to foster students' curiosity, innovation and openness to learning and change. The focus on change and action orientation in the New Nordic School manifesto is highlighted, which aims at enabling children and youth to be co-creators of a democratic and sustainable society socially, environmentally, economically and culturally through the pedagogical practice, education and actions. Amongst others it is mentioned to develop learning spaces that are based on considerations and academic ambitions allowing time for play and inspiring teaching across subjects and physical limits. Thus, it supports many of the aspects behind goals of action competence and the principles related to Education for Sustainable Development. The attention on partnerships and projects with private and public institutions, including farmers, school garden projects and science centres combined with additional hours and flexibility in the school week can therefore support more farm visits and closer farm-school collaboration.

The Ministry of Food, Agriculture and Fisheries is also supporting efforts in schools to improve food literacy and food culture. A means to increase children's knowledge about where food comes from and food quality, the Ministry is supporting a development of school gardens including

collaboration with local farmers across Denmark in cooperation with the Ministry of Children and Education. The former Minister of Food, Agriculture and Fisheries explains:

"In school gardens, students are allowed to grow their own tomatoes and carrots, they get outdoor experiences and the opportunity to experiment with making and enjoying food. It provides space to learn in a different way with curiosity and creativity, and then children learn something about where the food comes from" (Ministeriet for Fødevarer, Landbrug og Fiskeri 2013)

Promoting outdoor and gardening experience, experiments with cooking and tasting food and learning where food comes from are some of the rationales mentioned here by the Minister of Food. Both ministries will support the dissemination of school gardens initially with nearly 270,000 Euro and possibly with more after the initial 2 year start-up initiative.

4.4. Stakeholders in farm-school collaboration

The main stakeholders in farm visits and food and agricultural education in schools can be grouped into the following categories:

- Farmers
- Food and agriculture interest organizations
- Teachers
- Schools
- Political players – Ministry of Children and Education and Ministry of Food, Agriculture and Fisheries
- Science centres and other organizations.

The main drivers are of course farmers, who take a strong interest in inviting schools and others into their farms. They are strongly supported by food and agricultural interest organizations and the Ministry of Food and Agriculture specifically two organizations: the Danish Food and Agriculture Council and Organic Denmark (later the organic producers' association). As both promoters of farm visits to schools and providers of funds and educational materials about Danish agriculture, organic agriculture, food consumption issues, health, nutrition and cooking related issues. Implicitly or explicitly, these organizations have specific interests too behind their work to promote farm visits and other types of collaboration with farmers. This will be further elaborated in section 4.6.

Along with these agricultural interest organizations, a few other players from the industry are worth mentioning here. Arla Foods is a global dairy company and a co-operative owned by dairy farmers[x]. The company donates a number of free gifts, which are handed out during farm visits at farms supplying Arla Foods with milk. The gifts include free milk, leaflets, bags and shakers for students to make their own butter from cream at home or in the classroom. In addition to this, Arla Foods also offers visits to their dairies to 3rd to 6th grade students. Visits normally include a tour around the factory and a chance for the children to make their own yoghurt, butter and cheese. A key objective

of the visits relates to food literacy: specifically that the schoolchildren understand and see how many products come from a cow and its milk and that they get a chance to make some products themselves as part the hands-on activities during the visit. Arla Foods also encourages teachers to prepare the students before the visit and follow up afterwards. Arla Food's website refers to DAFC's educational materials on cows and milk production, which can be used to prepare the students beforehand and work with the topic back in the classroom.

None of the case schools, however, visited a dairy, although some of the teachers mentioned that this would contribute well to their food and agriculture theme. For many, however, an obstacle to additional visits to other part of the food chain is lack of time. Arla Foods in collaboration with DAFC has a short film about the cows, the milking process and the transport of milk from farm to factory and what happens in the factory, especially the food safety measures taken along the way. Sometimes the schoolchildren see an Arla Foods milk truck pick up milk during their farm visit.

In the case of the organic farmer's association (producers' association) in case study 2, these initiatives were, as mentioned already, supported actively by Coop Denmark, a member-owned retailer. Apart from Coop's strong commitment to fair trade with developing countries, they also support ethical trade or fair trade with Danish producers. Coop Denmark also has a school targeted profile on their website with educational materials and a focus on fair trade, climate/CO2 reduction, nutrition (food pyramid), cooking and sustainable consumption issues. Their support of schools' visits to farms in the pilot phase of the aforementioned project has been to strengthen local community (i.e. by creating links between farmers, schools and Coop shops) and fostering children's ability to make informed decisions as consumers, which are based on ethical and environmentally friendly considerations. Topics like sustainable consumption, climate friendly foods and understanding labels and chemicals are covered to enable students to make informed decisions about what they consume.

On the opposite side of the table from the agricultural and industry interests are the teachers, who generally act very independently in regards to taking their students on farm visits. Teachers in Denmark generally have significantly high autonomy. The case study 3, however, is exceptional in the sense that the teachers collaborate more closely both within the three schools but also between the schools. This collaboration is about developing, planning and implementing joint agricultural activities related to their science teacher profession, but also about sharing knowledge and equipment.

In many of the case schools, school managers play a largely passive role in supporting and promoting the use of farm visits, food and agricultural education and other types of farm-school collaboration on their schools. Yet, there are exceptions to this. In case study 3, the start of the science network activities was promoted initially by the municipality and the school management, and then taken over by the teachers. The success of the network, but also a strong ownership amongst the teachers, has resulted in the food and agriculture activities now being a permanent part of the science curriculum in all 4^{th}-6^{th} grades and supported with planning hours for the teachers by the management of the respective schools. The school south of Copenhagen in case study 4 is also

an exception: as mentioned the school management has restructured the school into a holistic school, where teaching outside of the classroom is an integral part of the school day, whether this is in the school kitchen/canteen, in the green around the school or on a farm visit. According to the school manager many of the students at the school normally do not get outside of their community. With children from resource-poor families, the aim of the school management has been to offer all students outdoor learning opportunities. Teachers have received support to upgrade their skills in outdoor learning pedagogy from trained nature guide.

Existing farm visits and other collaboration between farmers and schools is largely driven by agricultural interests and to a lesser extent by individual teachers, who see the importance of integrating agriculture in their teaching. The increasing political attention in Denmark on bringing the education closer to real life and making connection between schools and businesses supports further expansion of farm-school collaboration. In a sense the school reform directly supports the already existing programs, which have been largely driven by farmers, the agricultural sector and - as will be elaborated in the following section - the few motivated teachers, who actively use farm visits and other types of collaboration and food, nature and agricultural themes in their teaching.

The Minister of Children and Education, has visited DAFC's supported farms and in a short film highlights the important perspectives of the farm visit offering a place where children, through experiential learning, can combine theory and practice. The Minister stresses that agriculture is especially essential to be included in the teaching in schools, as we all need to eat and can benefit from getting a holistic view on food and farming. Understanding the processes, which came before we bought our milk or meat in the supermarket and getting a comprehensive understanding of our society, is also emphasized by the Minister. In her argumentation for the importance of including agriculture themes, farm visits and collaboration between farms and schools, the perspective of dialogue with farmers in relation to environmental and climate challenges are mentioned as a benefit for both farmers and students:

"What's going on in such a production - and this is indeed very relevant because we all eat cheese and drink milk, and know what is going on from the cow I saw before and throughout the process till it ends up in the supermarket and I buy either a steak or some milk. It is about getting a coherent understanding and that farmers also have an interest in and then taking those discussions, for example about environmental problems and what about the slurry and CO2 emissions (...) what do you do about it. So it is also an opportunity to discuss where there are problems and what can you do about it?" (Interview with the Minister of Children and Education) (Skole - Landbrug & Fødevarer 2012)

The minister emphasizes the importance of a dialogue between farmers and consumers about how they farm. This can be a way of enhancing transparency, dialogue and promote trust. According to the minister, strengthening the learning through stronger theory-practice connections, learning through senses and enhancing the memory from a real life experience are some of the key benefits of farm visits.

4.5. Objectives and motivation from the farmers' perspectives

Farmers and farmers' interest organizations are key drivers behind farm-school collaboration. But why is collaboration with schools such an important priority amongst both farmers and agricultural interest organizations? In order to provide an overview of the different farmers, their background, type of collaboration with schools and affiliation with the case studies, an overview is provided in table 9.

Table 9: Overview of farmer interviewee's background and case study affiliation

Pseudonym	Gender	Background	Farm type	Production type	Products (main)	Case	Collaboration type	Location
Inge	F	Teacher	Part-time Community	Organic	Integrated	Case 2	School garden/visits	Semi-urban
Rebecca	F	Planner	Part-time Community	Organic	Integrated	Case 2	School garden/visits	Semi-urban
Anne	F	Teacher	Part-time Family	Organic	Beef	Case 2	Visits	Rural
Hanne	F	Teacher	Part-time Family	Conventional	Dairy	Case 1	Visits	Rural
Emil	M	Farmer	Full-time Family	Conventional	Pork	Case 3	Science network	Rural
Karen	F	Farmer	Part-time Family	Conventional	Pork	Case 1	Visits	Rural

According to the statements of the majority of farmers interviewed, it is not economic incentives that drive farmers to open up their farms to students and the general public. This is also confirmed by staff at DAFC working with farm visits, who point out that one of the main reasons for the low number of registered farm visits in rural areas located far from the city centres, such as Northern Jutland (as illustrated in figure 5) is that many farmers simply cannot be bothered with the registration. This is partly because they do not have a high number of visits and forget the procedure for registering their visits. It is also because many farmers according to the DAFC staff have the attitude that opening up their farm is a matter of principle, something important to the farmers and they are motivated by idealistic reasons. They want students to experience what a farm and rural living really is and increase transparency. Many farmers feel an obligation to take in students, because they feel it is important that people know where their food is coming from, but also to give a good impression of agriculture and ensure its continued support in the local community and in society at large.

For these reasons, many farmers are not interested in receiving any compensation for their time. However, as mentioned earlier there are regional differences. According to the DAFC staff, there are three dairy farms near Copenhagen, who take the majority of visits. This is especially due to geographical and transportation issues, which make it easy to reach these farms using public transport and within a reasonable time. One of these farmers was interviewed in connection with case study 1. For this farmer, the economic compensation has in fact been an incentive to take in

more classes, and being close to the capital area of Copenhagen, the farmer takes 50-80 visits per year, which can supplement her combined income from being a teacher and a farmer. In addition, it fits well into a family life with children. So the responses tend to vary on this matter depending on the location and personal reasons.

Whether or not economic incentives play a role, one of the most common underlying motivation factors for farmers to engage in opening up their farms to visitors, is to increase transparency and give a different view and real life impression of agriculture from the negative picture portrayed in the media. This is especially the case for conventional farmers. As one dairy farmer, Hanne, puts it:

"Well I would like to help turn around the negative image that used to be that farmers are grey and boring, that they pollute and destroy the environment, and that they are hard on the animals."(Interview with Hanne)

According to this conventional dairy farmer, there is often a general misconception amongst the schoolchildren that the livestock of conventional farmers are mistreated and sick. Showing students that her cattle are healthy and well taken care of is therefore important to her.

In general, the view amongst farmers is that it is critical that consumers and in this case students, are informed to make their own decisions. As several farmers stress, students need to understand e.g. the difference between organic and conventional foods, between Danish and imported foods to enable them to make informed decisions later on. Hanne, the conventional dairy farmer gives an example of understanding why there is a price difference between cheap milk from Germany and Danish milk, implicitly saying that better animal welfare in Denmark is a cause of this price difference.

"For me, I am not too concerned about a cow has been organic or not, when you eat meat. It matters to me if it comes from Denmark or not, because I have an idea that Danish animals generally are treated well compared to animals from other countries. We have some rules and frameworks that ensure that animals are treated better here than they are in many other countries. And I am very much against animal transports[xi]*. So about buying something; Danish meat slaughtered in Germany. I do not think it's ok to put pigs in a truck on Zealand to drive them to Germany. I think "then slaughter them at home." To import them, that I do not care about, but I do not think it is necessary to drive around with live animals. They know damn well where they are going."(Interview with Hanne)*

For this farmer, and other conventional farmers interviewed, there is a strong sense of pride in what they do, how they treat their animals and a concern about animal welfare in the system, which is reflected in the above statement. The importance of students – and consumers in general – understanding their products and the reasons behind price differences is mentioned in this statement by Hanne, the dairy farmer:

"I think you have the right to choose. There are some who choose the cheap milk from Germany because they cannot afford it otherwise. But I think that we should give our children the chance to have background knowledge about why there is a price difference between Danish and German milk. So… And why there is a price difference between organic and conventional milk. And the same with Lærkevang[xii]*milk. Why is it more expensive than conventional milk. Well then give children the knowledge and then they can decide themselves, that's it."(Interview with Hanne)*

Knowing where their food is coming from and providing students with real life experiences and more nuanced perceptions of agriculture are general objectives and motivating factors for most of the farmers interviewed.

The organic meat farmer in case study 2, where there is a combination of one day visits and longer collaboration with the organic cooperative, explains:

"We have some really great mornings …. It is often mornings, right. Some really good mornings and gee they are.... Well some start out saying "it smells", right. But then ... I think they come and would like to learn a lot and they also leave and have gained a lot of knowledge. Some of all that theory, they hear about in school, that they have understood out here that they have seen in real life. And it's also because I … there is a need for it. So we… It is not right that in Denmark we have so many people who grow up without having knowledge of where food comes from and I want to also tell about ecology. About what it does… so about what is involved in operating an organic farm. So about what conditions the cows have and the horses, and how we treat the soil, all that I want to tell so much about. And of course it's because I think organic farming is better than the other types of farming in many ways. Of course I don't say that. I do not say "Organic farming is just the best." But I tell about what organic farming means. And then the teacher of course, and the students themselves, can investigate what is the alternative to it."(Interview with Anne)

It is in other words about the passion of teaching students about where their food is coming from and opening their eyes to understand about agriculture, specifically organic agriculture. The farmers involved in closer collaboration with schools as seen in case studies 2 and 3, however, also see their role and motivation in an even broader perspective. The farmers involved in closer collaboration with schools emphasized the fact of being able to offer students a practical experience to learn complex theoretical concepts out in the real world as a key motivating factor. This was also mentioned in the previous quote. It is in other words about adding real life and practical dimensions to education, which is missing in traditional schools. As an organic farmer, Inge from case study 2 with a school garden plot on their cooperative farm puts it:

"One of the reasons is that they actually really want to be here, because some of the students who do not thrive well in the classroom... But when they come out here, they change. And children, who normally need support, can get a completely different day without all those conflicts, etc. Although we certainly have rules here, and I think that is reasonable and I think I am rather strict. Because there are many things I won't accept that they do, right... to the animals. There I am very… I have

some clear boundaries, right. They are troubled children, […] they learn well also in a different way here. And it is a super good day. […] some of them leave shining. It's simply amazing. So I think that's what gives me a kick. It is the fact that they have had such a great time. And think it has been so amazing and feel it has … I can hear them; they think they have learned something. All of a sudden ... it's a whole new world opening up to them. And they understand how things work, right. That's what the small children express too. It is really great. So the money is there only because we have to get them, right. It's not at all the driving force."(Interview with Inge)

In other words the joy of giving students eye opening and different experiences to what they learn in school is what motivates this and the other farmer quoted above.

The conventional pig farmer involved in the close cooperation with the three schools in case study 3 has an even broader and more ambitious perspective of renewing education in schools through farm-school partnerships in case study 3:

"So surely at some point public schools must realize that they need to innovate. And you can say that the project we have started here could hopefully contribute, in some way sowing seeds, to help bring about a renewal there. And it would be GREAT if we in the agricultural sector can help to be the foundation pillars for bringing about this renewal. I simply think that's something we should try to sell this project on; that we are helping to renew the educational project. This is some of what I think we should highlight; that we are doing something extraordinary in your dissertation."(Interview with Emil)

The farmer in other words sees the agricultural sector's role – and the role of other farmers like him – as being able to provide a unique knowledge and platform for more practical and experimental education, contributing to innovation and reform of the public school system. An explicit goal of the science partnership in case study 3 has also been to become an inspiration to schools and other stakeholders in other municipalities in Denmark.

For a few farmers, however, it is a success for children just to experience a farm and rural life. As a staff from DAFC explains:

"I was out on Monday, and that farmer he has LOTS of visits. So many students. He had experienced that they thought it was fun to groom the pony and feed the chickens. And then there was a corn maze. He had a lot of focus on what children like […] so they could feed the pigs and otherwise just have a nice day out there. […] And then ... I stood and observed and thought "I can understand how a few of the children go home from this visit without understanding ... that this guy makes a living selling milk, and this one must, the cow must have a calf for it to make milk." So some of these BASIC things. So they had had ... a nice day eating lunch in the hay and grooming the horse and enjoying themselves in the countryside." (Interview with Ida)

The focus on the production and on learning about agriculture was in other words not the key

motivation for this farmer described here. So although there is a strong focus on understanding agricultural production, organic agriculture and increasing transparency as a common trend for all the farmers interviewed, it is not necessarily the case for all farmers, like the one referred to above. For this reason, it is critical to reach a mutual understanding of motivation, learning goals and expectations between the farmer and the teacher prior to the visit.

4.6. Objectives and motivation from the interest organizations' perspectives

Even though the funding and resources for staff working on school related initiatives in DAFC and especially the organic producers' association is relatively small, these initiatives are viewed by farmers as being imperative and close to their heart. As one of the staff in the school unit in DAFC explains:

"The farmers who are active in the school contact, and who put in a great and also voluntary effort, who DO this passionate work... for them it is VERY, VERY IMPORTANT […] and it comes above all sorts of other agendas and ALSO economic and politically ones. So that is why it has a tendency to be very important." (Interview with Ida)

It is in other words, an area which is very important to the farmers that are engaged in this. Because of this, there has been many discussions about its importance and issues of compensation etc. over the years within DAFC. According to the DAFC school contact staff and farmers, the decentralized support for farmers engaging in farm visits has been reduced over the years. In the past, farmers met once a year and there were regional coordinators to support this work. These coordinators supported the farmers in terms of meeting with them, explaining to them how to do the visits with schools and sometimes also doing presentations at schools. The coordinators also did a lot of work promoting farm visits in schools and at teachers colleges. In an interview with a former regional coordinator, she explained that she is still doing some of this work in her spare time, although it officially ended around 2007, when the service was centralized due to budget cuts. The school contact staff of DAFC has taken over this work, and although it has become more centralized, the staff does travel around to farmers across the country to support them and explain to them about the educational materials and other issues. The staff in DAFC realizes that farmers, the structure and network that used to exist provided better support for the farmers (Interviews with Ida and Karen).

The motivation and objective of DAFC for engaging in educational activities is not surprisingly linked to the motivation of farmers. Thus, the overall goal and motivation is to foster public support for agriculture, create awareness and increase transparency within the agricultural field. In addition to that, in rural areas it is also about establishing connections between stakeholders in the community, which case study 2 and 3 are a good example of. These objectives are closely in line with the motivation of the conventional farmers interviewed: the motivation of presenting a more real life and positive picture of agriculture and the farmer. (Interview with Ida and Karen)

The motivation behind the activities related to farm-school activities by the organic producers' association has a slightly different emphasis: the focus is less on defending agriculture – specifically organic agriculture, which does not have the same negative associations amongst many consumers. Organic agriculture tends to have a more positive image in the media and public compared to conventional agriculture, asides from occasional stories of organic farmers cheating with the regulations etc. Rather, the focus is on explaining the principles of organic farming and the motivation by organic farmers for engaging in this type of farming. There is also the objective of promoting awareness to ensure support from future consumers. Although it is not mentioned specifically, the fact that many consumers make their food choices based on price rather than environmental considerations, is likely to be an important reason for the need to explain what organic farming is and how it is more environmentally friendly, better for animal welfare and thereby also more costly than conventional products according .

The organic farmers interviewed stressed that they are personally motivated by the meaningfulness of working with children and being "embassadors" for organic farming and nature, contributing to children learning about how and where their food is produced. As mentioned, the importance of offering a real life classroom to convert theory into practice was also stressed by several farmers and their interest organizations.

Like DAFC, Organic Denmark and later the organic producers' association have spent many resources developing their educational materials to ensure a proper pedagogical quality and academic relevance. It is in other words crucial that there is academic relevance in both the visits and also the educational materials used before and after to ensure that more teachers see the relevance of including agriculture and a farm visit in their busy schedule. According to the educational expert behind the materials from Organic Denmark, emphasis has been put on enhancing the academic perspectives of the educational materials, so that teachers could not be blamed for wasting the students' time. (Interview with Stine) To strengthen the academic relevance and students' learning, an extensive set of online educational materials were developed, including activities, workbooks and apps for smartphones by consultants from Aarhus University, Faculty of Education and Organic Denmark. The objectives with the educational materials to be used before, during and after the farm visit and the farm visits are to foster the awareness of children and youth of ecology and organic farming. A further objective is to strengthen the knowledge, interest and motivation of children, youths and adults in organic food, health and sustainable development. (Ruge 2012)

Nevertheless, the head of the producers' association working on Organic Schoolyards explains that they are having difficulties getting enough teachers to take students on visits to organic farmers, in spite these efforts.

4.7. Objectives and motivation from the teachers' perspective

The motivation by teachers for engaging in farm visits and related food and agricultural themes is closely intertwined with broader and specific learning goals. In asking about the teachers' motivation, the teachers often talked about more general and also specific learning goals. The statements and analysis of their motivation here are as far as possible based on statements that are broader and go beyond specific learning goals related to what they think the children should learn, but rather focus on a more personal level of motivation. In table 10, an overview of the pseudonyms, background and case study affiliation of the different teachers is provided.

Table 10: Overview of the background of teachers' interviewed

Pseudonym	Gender	Grade level	Subjects	Location	Case	Type of collaboration	Type of school
Laurits	M	6th-7th	Science	Urban	Case 2	School garden	Private
Annette	F	3rd-4th	Danish, science, Class time	Rural	Case 2	School garden	Public
Stine	F	4th-6th	Science, Danish	Rural	Case 3	Science network	Public
Bente	F	4th-9th	Science, Biology, Danish Sports	Rural	Case 3	Science network	Public
Trine	F	4th-6th	Danish (Science)	Rural	Case 3	Science network	Public
Morten	M	7th-9th	Biology	Rural	Case 3	Science network	Public
Sanne	F	3rd	Danish, Science, History, Math,	Urban	Case 1	Farm visit	Public
Katrine	F	8th-9th	Science, Biology, Geography	Rural	Case 1	Farm visit, Interviews by students	Private
Simone	F	3rd	Science, Home Ec.	Urban	Case 4	Whole-school	Private

The motivation of teachers for including food and agriculture teaching and engaging in various forms of collaboration with farmers tend to vary. However, there are also similarities across the cases: one of the biggest commonalities is that a farm visit, whether it is once or on several occasions, offers an alternative and real life classroom with a number of benefits for students to learn from, which the regular classroom does not. As one 4th grade teacher, Sanne explained about her motivation and the benefits of learning on the farm:

"It is more their deep understanding of things. That they remember it for the rest of their lives […], because much can be learned and then forgotten the following year and then the year after, you cannot remember it. But you will not forget such a visit. […] They become wiser. They

get a larger worldview, right, because they have been out and experienced different things." (Interview with Sanne)

The teacher is implicitly here talking about a broader bildung, which is about shaping their world view and life skills. In the cases where visits were single visits to a farm, like it was for this teacher in case 1, she and some of the others actually practiced taking their students on different visits and fieldtrips on a regular basis. The teacher Sanne had also taken her 3rd (later 4th) grade to a zoo to learn more actively how to feed farm animals, estimate how much feed is required and the amount of milk a cow can produce. They had been to a Stone Age village overnight and learn how they lived, what farming looked like back then and how agriculture has developed over time. And as part of another theme in science related to animals and food (sheep, cows and plans), the teacher had also taken students to a nature centre to learn about sheep and the class had had a school garden plot over a growing season. Sanne is in other words strongly motivated by the fact that her students get real life experiences, which expand their knowledge and that she assumes the learning to be more long-lasting than regular classroom teaching. Sanne has been inspired and motivated to take her students on many different outdoor excursions and the school garden program after taking a course on udeskole/outdoor learning pedagogy, which she and some other colleagues attended. Although it is very demanding to organize the excursions, getting a parent or another teacher to join as well as coordinating that the school garden was taken care of by parents during the summer vacation, Sanne has a strong inner motivation to integrate these visits into her teaching. She believes it is something the children will remember later on in life. It is, however, not without challenges: some of the children are challenging to take out of the classroom due to the fact that they according to Sanne misbehave. She often feels embarrassed when they are out on an excursion. This has partly been solved by some of boys staying at the school and not joining the class on their trips. Also the school garden experience was disappointing, as the yield was very low, due to the fact that the plot was not properly taken care of during the summer vacation.

Laurits, the teacher experimenting with the plot on the cooperative farm for a school garden project on potatoes was also very motivated by outdoor pedagogy:

"A couple of years ago I ran a project in a 7th grade, where it was… which we made into a outdoor class. And it was new at this school, and that … well it is basically about taking the point of departure for the teaching out in the world and not sit inside the school. So we started uh, I did at least, the way I work; we started out there and looked and said.... Well went out and got some data to take home or took some observations or results, or whatever, home, and then we worked theoretically with it when we got home." (Interview with Laurits)

This experience of working with the outdoor learning has motivated the teacher to do more outdoor teaching projects. In the school garden plot growing potatoes and doing related experiments, the teacher has applied similar didactic approaches as described above starting with the real world and practice related to organic potato production, collecting data on yield, starch and glucose content in potatoes and then looking at it more theoretically afterwards to explain what they have observed.

This approach, however, clashed slightly with the farmers' expectations of the students being prepared before their first farm visit. Laurits on the other hand planned his teaching so that the students would work with organic farming more theoretically *after* the visits to the farm, not beforehand as the farmers had hoped.

The fact that outdoor learning gives practical and essential sensory experiences is a key motivating factor for this teacher to engage in a school garden on the farm. Laurits explains the benefits of linking practical sensory experiences with theory like this:

"An outdoor pedagogy is based on us going into the real world, get some sensory experiences and uh some tangibility, which we can use as some 'hooks' on which we can hang our theory .... Uh uh an earthworm…so when you have been standing with soil and earthworms crawl all over the place, well yes… and you have mixed in the cow dung … Then we can talk about fertilizer and we can talk about earthworms; what it does in a completely different way. And now that we are working with groundwater: well, uh loamy to sandy soil. It may seem as though all children have experience with that. But it is just something different when you have stood there and turned topsoil around to get something to grow. And then just to talk about topsoil, what kind of a concept is it. And just the three times we were out there and just the one time when they had potatoes in the ground, uh it gives a lot of memory-related imprints and experiences we can draw on. And that's just a tiny drip. The more of these kinds of experiences you have the better. That's at least the basic principle." (Interview with Laurits)

Apart from the uniqueness and effectiveness, according to the teachers, of learning on a farm (and other outdoor) environments, the motivation is also very much related to the importance of learning about agriculture and where our food is coming from out in the real world. This is similar to the motivation of the farmers. This is mentioned by several teachers, especially the ones engaged in longer types of collaboration (i.e. case 2 and 3). As Bente from the science network in case study 3 puts it:

"So ... it was actually there that the initial thoughts started: well, we have to create contact to a farm. We live in the countryside, but there are very few children who know anything about agriculture. And it is gradually becoming our heritage. It is disappearing more and more ... it is changing to large-scale productions and the small farms, they disappear more and more. So fewer children know anything about it. If you only say "crops", "what is a crop?" They do not know it. (Laughs)." (Interview with Bente)

In other words a strong motivation factor has been to create an understanding of agriculture, which children (and adults) are becoming further and further removed from in today's societies. This broader understanding and awareness-raising of agricultural issues and our agricultural heritage through farm visits or closers collaboration is, however, also motivated by teachers seeing an academic benefit of working with agriculture and farm visits. Another teacher, Stine in case study 3 explains this motivation:

"Well first and foremost, I accept the purpose about the children getting an insight into what is it about the soil and they get an insight into what makes a farmer, and what it is he needs to do before he can even put something in the soil. And I think there is an incredible amount of professionalism in it, also because they've become much criticized "but they fertilize too much" and "it flows into our creeks" ... and there we have some tests at home that actually show, well if you apply too much fertilizer, then nothing will come up. The plants must get only just as much as they can handle. If they get too much, the plants die." (Interview with Stine)

The teachers collaborating in case study 3 are in other words motivated by the possibility to work in an outdoor and different learning environment as well as the opportunity to combine academic/theoretical objectives with practical teaching and increasing the connection to and understanding of agriculture and where food is coming from. On a more personal level, some of the teachers also seem to be personally motivated by the fact that they have a professional network, where they can get inspiration and exchange ideas with other science teachers and real experts within agriculture, such as a farmer and a plant production consultant. Many teachers lack this kind of professional community. Bente, one of the teachers expresses her motivation and the benefits like this:

"It's quite amazing that we have such a professional science network, where we can get EXPERTS in and can tell them about it, because although we know quite a lot as science teachers, but certainly not one-tenth of ... yes one hundredth of what they know. Because they know it and can explain it to the kids what it is all about. I'm simply ... so such a network, it's priceless. As simple as that." (Interview with Bente)

The opportunity to work with local companies and other stakeholders is an important motivating factor for the network and the teachers. As this teacher explains, it was also an important initial reason for initiating the collaboration:

"Well actually we wanted to create a collaboration..... From the very beginning it was because we had to create a partnership with some companies. And then start discussing a little ... well, what kind of companies should it be and why should we do it? Well, we then take for example science, for that we could get hold of a farmer. Because the academic objectives of the science course demand that we work with agriculture… and organic and conventional farming. And based on that we planned, and we got a hold of this particular farmer named [Emil] in our case and created a relationship with him. And he has then become our school farmer." (Interview with Bente)

Apart from the sensory experiences mentioned earlier, which a farm visit or longer collaboration offer, the farmer and other experts play a very unique role, which some of the teachers mention to be of special importance and source of inspiration and motivation. Bente from case study 3 emphasizes this with excitement:

"They can help us with all the questions we have as teachers, because we are not experts, you know. And then we can go to [Pia] and ask "listen ....?." Then she can say " now you just ... such and such and such." It is quite exceptional to have such an expert on board. Then we also have Danish Food and Agriculture Council on board, which we can draw on if there is anything. And they are also helpful in finding things and ... materials and books that we can take home to the schools if we need. So I ought to say 'oh boy.' And then of course [the science centre], it is [Thomas]… He is just a goldmine in this regard."[….]"[..... They] are simply so amazing all these events. Plus the fact that you as a teacher learn something new from the experts. It is simply a gain. (Interview with Bente)

Apart from the farmers and other experts providing important expert information, teachers also mention the importance of farmers both being authentic experts but also able to provide students with their clear views, which are also important in motivating the teachers and in the end their students. The fascinating by students of meeting an authentic expert in the farmer was evident in all observations and is expressed by Bente here:

"Well they think it's GREAT to talk to a real hick. Like they said, 'It's a real farmer', 'yes it is' I said. And he is super good with the children, [Emil]. Damn they love him."(Interview with Bente)

Another teacher, Laurits, points out how the clear opinions of the farmers at the organic cooperative shine through very clearly, albeit expressing concerns that the children risk getting a one-sided impression of agriculture; that organic agriculture is the only right way to go. He does not want his students to be one-sided but to learn that conventional agriculture has its benefits and justification too:

"So you meet an attitude out there, and you meet such a clear position that this is organic. And they have their ideas" […]"In my opinion, the main aim has been to make the concept of ecology concrete. And make what you can say the difference between conventional and organic, what can I say prepare them to be able to distinguish between the two. But uh we are lacking, you can say the conventional part is still weak. There is a risk of some delusions, if we do not get a better grip on that part of it. I think. So we of course have talked about it, and I've also tried to clarify some differences, but I think it's important that they do not throw conventional agriculture in the doghouse. When we talk groundwater, then it's also quite real that pesticides etc. are a threat to our groundwater and agriculture has its share of.... responsibility. So I am in any case aware that we do not to end up in a delusion where we shoot it to the ground." (Interview with Laurits)

Finally for teacher Annette at a school near the organic cooperative, she was motivated to accept the opportunity to follow a longer school garden project at the cooperative because it offered many development opportunities for her 3rd grade students. Annette was motivated by the opportunity of a longer outdoor programme with concrete activities, where the children could develop a sense of community feeling and social skills.

4.8. Challenges and opportunities from the stakeholders' perspective

In the following section, the main challenges and opportunities identified by the farmers, teachers and the agricultural interest organizations will be presented. Since the teachers interviewed in most of the cases were teachers, who were motivated and convinced about the benefits of taking their students to farms and collaborating with farmers and other stakeholders, only few interviews were conducted with teachers who faced difficulties working with agriculture and taking their students on farm visits. Generally it was difficult to get interviews with teachers, who had challenges or others who did not use farm visits and agriculture in their teaching. However, this was not the main focus of the research to investigate challenges but rather the learning goals and motivation of those who do. A further limitation was that teachers were not asked thoroughly about their own background and interest in agriculture, but primarily about their educational background, interest and experiences in working with agriculture and farm visits in their teaching.

4.8.1. Challenges and opportunities from the farmers' perspective

The farmers' statements related to challenges for spreading and increasing farm visits and farm-school collaboration can be grouped into the following categories: 1) economic and transport challenges, 2) reaching the interest of teachers and schools and 3) practical challenges. However, they also saw opportunities in reaching out to schools and families more broadly through their own efforts and through students and teachers promoting farm visits back home and in the schools.

Economic and transport challenges

A key barrier for farmers to get schools to visit their farms is the economic. Although as mentioned earlier some farmers, who take visits from schools only occasionally, do it for free, all the farmers interviewed for the case studies, receive some kind of compensation for their time. In case study 1, where the conventional dairy farmer near Copenhagen takes in several schools per week, much time is spent doing the farm tours and other activities as well as administrative tasks. This farmer and the farmer, who has a closer collaboration with the science network in case study 3, are both getting a financial compensation for their time through DAFC. However, for the farmers in case study 2, where the farmers in the organic cooperative do it on a weekly basis and the organic meat farmer a bit more infrequently, it is time they could have spent on their regular jobs as a farmer and off-farm work. Although these farmers stressed that they are not in it to make money, they still need a financial compensation for their time. As Rebecca, farmer at the organic cooperative explains:

"It is the largest barrier, it simply is ... we need to take time off and for that time we have to be paid for. And if you are working, so if you have your own farm, then you also need to be paid. One has to get someone else fill in to do what you should have done that day." (Interview with Rebecca)

The economic challenge is primarily affecting farmers, who open their farms to schools through the producers' association, as they have to search for funding on an annual basis, which makes funding an on-going challenge.

Linked to the economic challenge is also transport. Most farmers and teachers mentioned that transportation was an issue, due to the location of the farm in relation to public transport access or possibility to bike to the farm. It is important that the teacher and students can reach the farm within reasonable distance and travel time from the school. The farms in case study 2 were within bicycle reach for some of the schools interviewed. However, most teachers rely on public transport, as renting a bus is too expensive for most schools and no funding is available to cover this expense. All of the farmers interviewed were located within 30 minutes to 1 ½ hours transportation time from the schools. The farms located further away are not able to attract visits from schools on a regular basis.

For the farmer, Emil, in case study 3, the economic and transport challenges for schools to get out and visit a farm was an important issue, which he thought should be prioritized economically even higher than it currently is by the decision-makers in DAFC:

"It is simply to make sure that this does not turn into a problem. Because you can spend so much money on big advertisements for adults, but imagine if we could get 15,000 young children out - or ambassadors - but if it is a problem to get out, it is only 7000. I just think it would be a damn shame. And I think, you know, that all students in one way or another should come out every year to hear something about agriculture. This, the ones we're talking about are maybe 10-15%, who have trouble getting out, and it's really a pity that they cannot get out. And we should really spend some energy on making sure that it never becomes an issue…At any cost. There is a heck of a lot of money in the chest. It is only a question of where to take them from. Then they have to save money on the TV ad first. Then they would simply have an entire annual budget for a bus. That's what we're talking about after all."(Interview with Emil)

This statement once again emphasizes the importance, which some farmers attach to the work of getting students to learn about agriculture.

Reaching the interest of teachers and schools

Another key challenge for the farmers and their interest organizations is that it is difficult to get teachers and schools to take an interest in and knowledge about the opportunities for schools to come to their farms. Many farmers are very eager to take in classes. Yet, even when they have funding secured, it is still rather difficult to attract teachers and students to come to their farms. One challenge is the fact that farmers have to compete with other priorities of the teachers. There are a wealth of educational materials and possibilities for visits to and collaboration with other companies and public institutions. So to get teachers and schools to prioritize what they have to offer and include it as part of their teaching is a challenge. This is where the teachers' own background, interests and prerequisites might play a key role in their choice to work with agriculture outside of the classroom. This is a challenge which both DAFC and some of the organic farmers are working to overcome. As one organic farmer, Anne explains, she is trying to promote her farm and other

organic farms to the local schools:

"When only the money is in place… That has been one of the major challenges. And well, then there is also the competition with all the other teaching materials which teachers also get, and all the other requirements that teachers must live up to all the time. Where I, we ... We are some who have been down to the […] school in […] to talk about ecology, by doing a program with a class that actually gets around many themes. Not only science themes but also, social themes, which needs to be brought up. Well about the social life of the class. And you can say ... well we have done these concrete initiatives. Well, because it's also an excursion. It is also a sort of class collaboration, when they come out here. About getting out here and about the conditions existing when you do an excursion with a class. So it also means something for the friendship." (Interview with Anne)

Broadening out the benefits of farm visits to get teachers to realize the multiple opportunities and benefits other than agricultural ones is critical. This approach has led to the long-term collaboration between the organic cooperative farm and the local 3rd grade and their teacher in case study 2. As a result, the Danish teacher takes her children on weekly visits to the cooperative farm to develop social skills and a sense of community in the class; science and learning about ecology has been an added benefit.

Practical challenges during the farm visit

A challenge for the farmer (and to some extent also the teacher and students) in terms of the actual tour and activities on the farm, is when students are not prepared: lack of preparation can be due to the teacher not having introduced the students to agriculture and field trip in advance, but it can also be about the teacher forgetting to bring paper and pencils for their students and parents not dressing their children appropriately for the farm visit. Cold and rainy weather combined with too little clothing or shoes during a cold, windy spring day can greatly hamper the students' experience. Although farmers always advice teachers to ensure that their students bring rubber boots, there are usually always students who come in stockings and small shoes or are otherwise not dress properly. From observations on farm visits and students reports afterwards, it is quite clear that these practical matters greatly hamper the students' concentration and learning during a farm visit, if these practical matters are not taken care of. During several of the observations there are students who did not have enough warm clothes on and already in the beginning of the farm visit complained about being cold. Even the students who were dressed warm can freeze during a cold, windy day on the farm. This affects their concentration and some of the students' reports about the farm visit reflected that being cold takes away their attention from other impressions on the farm. It demands a lot of preparation and contact with the parents by the teacher to make sure that clothing is appropriate. In the view of several farmers, and the way the educational materials have been set up, teachers should prepare their students beforehand and the teacher should ideally bring paper and pens for the students to take notes. However, this is often not the case.

Finally, a challenge for some farmers is having facilities on-farm such as toilets. The farmer near Copenhagen in case study 1 is challenged by this with several visits per week from schools. This is solved by finding a private spot on the farm, where especially the girls can go to the toilet outside. However, it is not an ideal solution and the farmer has asked DAFC for funding for a toilet, which according to DAFC was provided.

Opportunities in reaching other teachers and the parents

The teachers and schoolchildren, who do go on farm visits, have an important impact of inspiring other teachers and parents to also visit farms. According to most of the farmers interviewed, students ask about coming back to the farm with their parents. Some of the farmers have events called Open Farms, which are held on weekends a few times during the year, where farms are open for visits from the public. This is promoted through DAFC, but also other farmers consider this as a way of getting in more direct contact with parents:

Anne: "So some of the children, they have actually asked if they can come again. And I'd really like to be able to say "yes the date is ..." So I'm going to try to do that.
Interviewer: Do you mean with the parents, or?
Anne: Yes with parents, with their families. They could take the bus out. […] So they could just walk around and look." (Interview with Anne)

However, according to one farmer it is still a challenge to get people to come to the farms in spite of the farmers' willingness to take in visitors. But some children can certainly be important ambassadors for getting their parents to come. Also at the schools, students and their teachers, who have already been on a visit to a farm, can be effective in spreading their good experiences through word of mouth. Hanne, the dairy farmer located close to Copenhagen explains:

"Well my impression is that once a teacher has tried it at a school, then half of the teachers come during the following few years [...] From the same school, right. So I have some that come regularly every year and then I have some, who come. ... It's usually 12-14 schools from inside Copenhagen, I have the most visits from."(Interview with Hanne)

However, inspiration from other teachers is not necessarily a guarantee for getting more teachers and classes out to the farms.

4.8.2. Challenges and opportunities from the interest organizations' perspective

The DAFC and the organic producers' association are experiencing similar challenges as those mentioned by the farmers above in terms of reaching out to teachers and getting more of them to go on farm visits and use their educational materials. In 2006, the OD conducted a qualitative study in collaboration with a researcher from Aarhus University based on interviews with respectively 10 farmers and 10 teachers (Breiting and Ruge, 2006). The study focused on teachers' and farmers' experiences with farm visits, as part of an effort to promote farm visits and enhance the learning

outcomes of the visits. The study highlighted the importance of pre- and post-curriculum integration of the farm visit to ensure that the students optimize their learning.

In 2010, DAFC conducted an online quantitative survey amongst teachers, which was aimed at better understanding teachers' background, knowledge about farm visits and barriers and opportunities for going on a farm visit. The survey was distributed through the public schools' online news site, www.folkskole.dk. DAFC staff was curious to know what teachers see as main barriers and opportunities for farm visits. This included questions about teachers' background, knowledge of agriculture, economic factors and transport requirements and other related questions. The on-line survey had a very low response rate of only 60 respondents, 25 of whom were from the capitol area of Copenhagen. The findings show that nearly 45% of the respondents saw opportunities in integrating agriculture in interdisciplinary theme weeks and in subjects like science and biology and also Danish (40% of the respondents). Although they saw opportunities in farm visits and knew about the possibilities, 19% had not been on one and another 17% of the respondents did not know about the possibilities at all.

Transport and economic challenges – and opportunities

The transport challenge is identified as an important and reoccurring challenge, which the DAFC also struggles with when trying to promote farm visits. In the survey from 2010, participating teachers were asked about the limit in terms of the time that they would spend to get to a farm. The survey showed that the majority of teachers were willing to spend up to 1-1 ½ hours on transportation in total. One of the ways in which DAFC is trying to overcome this challenge, is to make it more visible on their website, where in the country farms are located. Their website was updated in 2012 to ease the access to educational materials and also make the information about how to find a farm nearby more easily accessible. The website has links to various websites of farmers with travel information. Further work in this regard, which they consider, is to work more closely with bus companies to ensure that bus routes and bus stops are located near farms with many visitors. The main challenge faced by the producers' association for Organic Schoolyard and its farmers is that there is an on-going challenge of securing funding each year.

Reaching and disseminating educational materials to teachers

Both DAFC and OD have spent many resources on developing educational materials, longer program/themes on organic food and making this easily available on their websites. The consolidation of sectoral interest organizations within the agricultural sector in 2009 has made access to educational materials within DAFC's School Contact easier. In 2010, OD launched an "ecology package" *Organics in Schools,* which included various educational materials for the foundation level, intermediate level and upper level in the Danish primary schools. Apart from the educational materials targeting the different levels, guidelines for teachers were developed on how to use these. Furthermore, the Organics in School Program provides consultancy advice on how to convert to more organic food in lunch boxes, school tuck shops and canteens, thus trying to integrate the supply of organic foods in schools with learning about organic agriculture and food.

DAFC and OD have realized the importance of developing educational materials that are directly linked to the educational goals of different subjects by the Ministry of Children and Education. For this reason, the expertise of health and environmental education experts from Aarhus University has been used to develop the didactic content and methods of the educational materials, including readings and exercises before, during and after the farm visit. However, staff from both the current producers' association for Organic Schoolyards and DAFC worry that teachers might not use the materials the way they were originally intended by reading the guidelines. Interviews with teachers confirm that they often use the educational materials selectively. The same goes for the farmers, who according to DAFC are used to doing the farm visit their own way: many do not see the rationale behind having hands-on work stations on the farm for the students, which DAFC's educational materials are based on, instead of doing a more traditional tour around the farm. For OD farmers it is appears to be easier to get the farmers on board, as the farmers participating in the Organic Schoolyard project meet occasionally to exchange information and directly urge the teachers, who get a free trip to a farm, to use the educational materials from OD. DAFC has almost ten times as many farmers participating in their programs and have had to reduce the networking activities between farmers, although consultants still visit farmers and inform them of their resources and The Class in the Stable program. However, getting farmers to use the work stations developed for this program, using their new website and registering visits is challenging. As the DAFC staff explains:

"On the one hand, we now have a new portal, which is very easy and user-friendly, putting all things in system, which actually…. is important … for teachers. But it is up against a tradition and a practice, which DOESN'T AT ALL need that digital crap.[…] THEY know each other and they have always done it that way. "And it's Åse from the school over there, and she has an agreement … bam, bam off you go." (Interview with Ida)

From this statement, it is evident that many farmers prefer the informal relations, some might not be so familiar with using the internet or do not see the need for a more structured educational program available on-line. This points to a strong sense of autonomy of the farmers, but also to a limited understanding of teachers' needs and of how children learn best. On the other end of the scale, DAFC sees a strong need amongst teachers for strong support and step-by-step advice, due to limited knowledge and experience amongst many teachers of working with agriculture and going on farm visits. Easing the access to information and providing support for teachers is therefore an important area of focus in DAFC.

One way in which knowledge and materials about agriculture and farm visits can be effectively disseminated is through targeting students at teachers' education. Future teachers need ideas and educational materials for their teaching portfolio, which can be an opportunity for spreading advice and materials on farm visits and food and agricultural education. Apart from doing this at educational fairs, a farmer with a networking function and some of DAFC's consultants working with teachers at teachers' educations can spread best practices and educational materials.

Political discourse and framework conditions

The interest organizations recognize that the school reform in Denmark and the political discourse emphasizing more practice and real life integration into the curriculum and teaching in the schools is an opportunity for more farm visits. The Minister of Children and Education's visit to a farm and interview highlighting the educational benefits of collaboration between farmers and schools is something the DAFC sees as an opportunity for increasing the focus on agriculture in schools and number of visits to farms. The focus on out-of-school learning and hands-on activities in the reform is a discourse and a focus, which DAFC sees significant opportunities in. The increase in weekly teaching hours is also an opportunity for more time to go on excursions. A suggestion of having farm visits and food related activities written into the Ministry's curricula for various subjects was mentioned by DAFC.

Concerning the discourse on farm-school collaboration, DAFC staff makes an important point. They see the limitation in their own focus on the website and the focus of farmers. This focus is on promoting an understanding of agriculture amongst students and the public in general. However, this could be a barrier for promoting a wider interest in the schools. They are well aware of the fact that this is the interest of the farmers, but not necessarily the interest of all teachers. For this reason, there is a recognition that a focus on food and food literacy, i.e. on where the food is coming from, could have a broader appeal with teachers, rather than the focus on agriculture. Food is in other words a common platform, which ties farmers, teachers, students and their parents together.

4.8.3. Challenges and opportunities from the teachers' perspective

The challenges and opportunities experienced and identified by the teachers to some extent overlap with those identified by farmers, the organic producers' association and DAFC. However, some are unique to the teachers.

Time, transport and economic challenges from the teachers' perspective

The transport and economic challenges identified by the farmers, organic producers' association and DAFC were identified in relation to this being a challenge for teachers and schools. Although the fee for the farmer is normally covered, schools still have to set aside money to pay for transportation to and from the farm. Transportation costs can, however, be a challenge for most schools, especially if they go on several visits like they do in case study 2 and 3. Some of the teachers solve this by making a bicycling trip to the farm with their students depending on the distance. This was practiced both with schools in case studies 1, 2 and 3, where some of the schools were within reach of a farm by bicycle. At the rural private school in case study 1, the older students at the rural school could go to nearby farms by bicycle. Laurits in the private urban school in case study 2 made the bicycling trip to the farm part of their outdoor education concept. His students had just taken a bicycling test and got a chance to practice. This was a way of overcoming transportation barriers, thus enabling several visits to the field at the organic cooperative farm.

The fact that funds have been available to cover the expense of the farm visit has been an opportunity and an enabling factor for the teachers to be able to do farm visits or closer collaboration. If they had had to pay the full 70 Euro per hour fee to go on a farm visit, they most likely would not have done it.

Time and practical issues related to that are also a barrier identified by some of the teachers. With limited hours for certain subjects like Science, taking a whole day out of a school week can be a challenge. It requires motivation from the teacher's side and flexibility at the school to change the schedule. For teachers like Laurits these practical matters create limitations in terms of how many times during the year, they could go to the organic cooperative farm. They ended up with three visits.

Sanne teaching in an urban school in Copenhagen also views time and transportation costs as limiting factors for doing more excursions, even though she already takes her students on numerous excursions during the school year:

"Well, we would also have liked to have been to a dairy, but uh, and see what then happened with the milk, but there was not, but it was too far to get there and uh, it's not so easy to get away with such a class, because then there is a need for a substitute teacher in the other classes and you have to have a helper and the school cannot really afford that. And it's also expensive with transportation. We do have a valid travel card, but only after 9 a.m. […] That means if we have to go far, then we need to leave at. 8 We left at 7.30 a.m. this time and it cost 400 DKR or something like that, even though we had such a card, just to get one way" (Interview with Sanne).

Although visiting a dairy to get a proper sense of farm-to-fork processes would have been useful, she is not able to find the time.

Also the teachers in the science network in case study 3 mention that transport costs are an obstacle, especially for being able to take their students to an actual farm. Otherwise transport barriers are solved by organizing events at the science centre located close to two of the schools. This enables the teachers and students easy access during the event days and to tend to their crops the rest of the season. Although the nearest farmer is located 10-12 km away reachable by bicycle, the teachers have not used this as an option to get to visit a real farm. The teacher argues that it is too much time to spend getting there by bicycle. However, other teachers, who are also teaching sports at one of the schools, do reach an event site located in the forest for the harvest event by bicycle. Other schools rent a bus.

Weather and practical conditions

There are a number practical challenges and weather related conditions, which influences the experience once the teacher and the students reach the farm.

Weather conditions can greatly affect students' experiences and attention during a farm visit. For students, who have been freezing during most of a farm visit, it could be one of the key things they remember afterwards. Weather and time also influenced the experiences of 3rd graders, who had a school garden. Sanne, the teachers was greatly disappointed with this experience, because her students were not able to successfully weed their plots during the summer, as they did not think weeding was necessary during a summer with lots of rain. As a result, they were only able to harvest a few carrots. Sanne recalls:

"Then they hardly harvested anything. And then they thought it was "totally ridiculous" to have to work there, right. All that work for 3 carrots or something (laughs). But those who had cared for it, they got a lot from it, right." (Interview with Sanne)

Elaborating on this, Sanne explains:

Sanne:" I think most experienced,' wow it is hard to have vegetable garden.'(laughs)'What a waste of energy when nothing comes out of it.' So I'm afraid, there are many who feel that way.
Interviewer: So it has not been so....
Sanne: So it has not been what I had expected. I imagined how we harvested a lot and how we would have a party with the parents." (Interview with Sanne)

Also the teachers and students in case study 3 experienced how most of their potatoes turned green, the wheat rotted and the soil was too hard to hoe the soil. Yet their harvest of maize was very successful.

Learning opportunities and challenges

In spite of these challenges, the teachers unanimously agree that there are numerous learning opportunities, which they observe in their students during and after a farm visit or several. Apart from the academic benefits of being able to learn theoretical concepts based on real life experiences and encounters with the authentic expert at the farm, they learn with all their senses making the teaching more interesting, which is something all the teachers highlight. Some of the teachers also mention that they have observed another area of benefits: the development of social competences. As one teacher Annette in case study 2 highlighted, the 3rd grade students in her class developed a strong sense of community in the class and learnt to work with each other. They all of a sudden interact with other students than they normally do back at the school and they experience each other in new ways. Several teachers also mentioned that some of the academically weaker students also get a chance to excel and the roles within the class shift. Altogether the children's sense of community strengthened according to the teacher, after the longer program at the organic cooperative farm. Of course, as the teacher points out, this is difficult to measure, but her observations have been positive.

The unique opportunity of getting advice from an authentic expert was highlighted by most teachers. The farmer and other experts provide a unique learning opportunity for students as well as

teachers. In the case study 3, the technical support from various experts within agriculture and science is key to their network. The farmer acts as a resource person during workshops with the pupils. As a teacher, Stine, stresses:

"*It just gives more…. more credibility, when we get professionals to explain things, rather than us showing examples from the internet or from articles we find in books*." (Interview with Stine)

Another teacher, Bente, tells with much excitement about the role and skills of one of the professionals from the science centre:

"He has a workshop with the children. And it's about humus in the soil. He's a former teacher, so he knows a lot about what he's doing. So it's very clear to us that he interacts with the pupils in a pedagogical way, which is often needed. Some children are bouncing off the walls and he knows how to get them to calm down. And he sees them and how they should be treated. And that's just fantastic." (Interview with Bente)

Making sure that all students are listening or at least participating in the activities can be a challenge just as it can be in the classroom and even more so. During observations it was clear that some of the students, in some contexts boys in other contexts girls, are easily distracted by either bad smell on the farm or their desire to run around the plot and fight with sticks or climb trees rather than tending the soil or planting seedlings. As Sanne, the 3rd grade teacher in case study 1 with the school garden in Copenhagen experienced:

Sanne: "Yes they would rather climb trees and run around and throw things. And it was a paradise and there were animals over there. And they were constantly over by the rabbits and chickens. It was much more interesting than the stuff with dirty hands and clothes.
Interviewer: Yes, it is a paradise but of course if there is too much work, it's not as fun.
Sanne: Well there are some who quickly lose interest if there is something that requires something of them." (Interview with Sanne)

Although the teachers never explicitly mentioned it, the fact that the teachers are in much less control of the situation on a farm or in a school garden, could also be a challenge – at least for some teachers.

Children's prerequisites

Especially one teacher felt that it was challenging to take some students on excursions. Although Sanne of the 3rd grade in Copenhagen has been taking her students on excursions for years on a frequent basis, she experienced frustration with some of the children. As she explains:

Sanne: "But I have been, I think there are many problems in this one class, right. So it's not just teaching. There are many other things to take care of all the time. […] So I'm pretty worn out.

Interviewer: Yes. Alright. OK. Yes. And how do you feel when you've had them out, um. If it has been a challenge of having such a big class with some, with some ...
Sanne: Because there are some pretty wild bilingual boys […] There are no limits to what they do. And there I am often embarrassed when we're out, right.
Interviewer: Ok, ok. So it's not that they become a little calmer when they are out, but it's rather...
Sanne: They have no limits to what one does and what one does not do […]
You can never turn your back towards them and trust that they behave nicely […] And it is just as much when we move about in buses and trains and things like that. […] I get really embarrassed by them, right." (Interview with Sanne)

During the observation of the teacher's farm visit, none of the challenging boys were present. Excluding the boys with inappropriate behaviour from the excursions was a way for this teacher to handle the problem. Also the organic cooperative farmers had had problems with students from the 7th grade. This caused some friction, as the farmers did not feel that some of the students behaved appropriately in the community. So from these two examples it appears that it can be a challenge to take wilder boys out of the classroom and into a farm. This point is further highlighted in this quote:

Sanne: "There are many troubled boys who cannot concentrate for a very long time. […] And so they spray with water and then the others start crying.
Interviewer: OK. Yes, yes. So it has, not even here they...
Sanne: It does not matter where you bring them. The academically weak can probably take advantage of it, right.
Interviewer: Yes, yes, but the wild ones…
Sanne: The children who can never concentrate on anything, who constantly make trouble, who continually cross boundaries and bother others, right. They truly have free hand there."
(Interview with Sanne)

Teachers' prerequisites

For the majority of teachers, taking their students on farm visits and other types of collaboration with a farmer is new. Annette and Laurits from the schools in case study 2, who had a closer collaboration with the organic cooperative, had never been on a farm visit before. Laurits had experience with other types of outdoor learning activities so the idea of taking his students out of the classroom was not new. Together with a few colleagues he had developed his own interdisciplinary program focusing on potatoes integrating science and mathematics perspectives. Developing his own science and mathematics related activities using the farm visits and supermarkets visits indicate that he is a very motivated, creative and innovative teacher, who thrives with new challenges. For him getting to take his students on bicycle to the farm and back was part of the experience.

Annette, from the nearby school in case study 2, also took students to a farm for the first time. The sponsored visits to the farm in the community, encouragement from the school head and the fact

that she could use the visits to develop her 3rd graders' social and personal skills motivated her to participate in the school garden project at the farm. She was not used to working with agriculture. For that reason, her motivation was also not on the academic learning (learning about organic agriculture), but primarily on social aspects. However, as she became more and more familiar with organic agriculture through the 10-12 farm visits, there was a change from primarily focusing on social aspects to also integrating more science-related and sustainability issues in her teaching. With the increasing familiarity with the farm, her willingness to talk about the visits and her students' learning increased.

For the majority of teachers taking students to a farm was completely new, except for one. Most teachers were very keen, motivated and eager to work with agriculture in spite of their limited hands on knowledge. However, TA, a teacher in case study 3 was not keen to talk about her experience. She explained that she faced challenges primarily because science was not her area of expertise; she had been asked to teach science and be part of the network activities. Similar to Annette in case study 2, who also was not a science teacher, she seemed somewhat uncomfortable working with science and agriculture. Her background was in teaching Danish and History. She, however, overcame these challenges by focusing on more familiar topics related to agriculture, e.g. animal welfare and the differences between organic and conventional agriculture, where she could use her competencies.

Only one of the teachers mentioned that she had been on a farm visit before. Sanne, with a lot of experience in taking students on excursions, had taken another group of students to an organic farm and was able to see a clear difference. She highlighted the fact that the conventional farm on her recent visit was more authentic and contemporary than the idyllic organic farm.

From the interviews it seems that most of the teachers educated to teach science were more confident and eager to teach about agriculture and go on farm visits, even though it was new to them. Other teachers seemed less comfortable and less knowledgeable about agriculture and farm visits. Adding to that, farmers and staff from DAFC also mentioned that some teachers simply feel insecure, when they have to work with agriculture and take their students to a farm. As one staff points out:

"By now I think … that I just like, am out and feel and see what it is that is a barrier … it is… well that agriculture is already so far away from ..... how shall I put it, everyday concepts and knowledge, and so on, and as a teacher .... teachers have a feeling that 'this is a field where I SHOULD know everything, but I know nothing'."(Interview with Ida)

The DAFC staff member here talks to teachers on a regular basis and heard this from farmers too: some teachers become uncomfortable outside of their own turf - the classroom - and find it difficult to find their role on the farm. For these reasons, DAFC and the farmers also try prepare the teachers for the visit by providing practical information about the visit, the teachers' role and otherwise preparing them and hearing what their needs are beforehand.

School management and structures

In case study 1 on single farm visits and case study 2 on closer collaboration of teachers and organic farmers, the involvement of the school management is limited. The farm visits and closer collaboration are largely driven by individual teachers or a group of teachers. Although all the teachers are able to change their schedules to fit in one whole day visit or several of them, the general support and role from the school management is relatively low.

However, teachers in some of the cases do manage to involve other students or teachers in the school or even to get the farm collaboration written into the annual plan of the school. In the rural school in case study 2, funds were available from Coop Denmark, and the students made a healthy organic breakfast event and shared their new knowledge about organic food with other students. In case study 1, they held an agricultural fair for the whole school. The 8th and 9th graders did creative presentations about agriculture for the rest of the school.

In the schools in case study 3, the school management initially supported the science network. However, financial challenges and lay-offs meant that teachers had to lobby the school management for the network to continue. As Bente, a committed teacher, describes here it took some effort to finally get the school leader to make the network become permanent at her school:

"The first year was fine. We got all the hours we needed. And then came all the crisis and layoffs and everything and minimum hours. And theeen he held back quite a bit. He didn't think it should continue […] But uh then I ran my own small campaign. Yes and put up signs "support agriculture" and I came with many, many options for how to work out the hours and came with A LOT of solutions. Because I just did not want it to shut down and said "well, we've only done it one year. Give us a break "and" it did not cost anything. It was almost all free "and "we didn't need transportation." Well I came with many suggestions, and then he held the meeting with the other leaders from the two other schools. And they then had to sit down and agree on whether it should be continued or not. Um and so fortunately, so they decided that it should. And they agreed on a fixed number of hours for all schools. Well so that all schools received the same number of hours. And we ran it through the science networks, where both, where we have some biology, some science, a little Grundfoss with the 8th graders. Where they compete against the other schools and then it is something about, I think it is the 3rd graders, who are also part of the network. And all in all, this network could get some hours and then we simply split the hours with the 8th and 3rd graders and agriculture got the second part. So that was that. Fortunately." (Interview with Bente)

However, this was not the case in all the schools: one school manager set aside both hours for a teacher and the coordinator. Two of the schools have teachers who are really motivated and eager about the network, whereas teachers at the third school are not putting the same amount of effort into it.

Case study 3 is a positive example of how a top down priority of improving science education in the municipality can lead to more resources for the teachers in terms of facilities and expert advice from staff at the science centre and also from DAFC. This initiative was welcomed by teachers, who have since developed a sincere ownership of the initiative – at least at two of the schools where the teachers are very active and motivated. Unfortunately, the municipality has cut the hours allocated for the staff from the science centre to work on the project. Fortunately, the strong ownership amongst the teachers has so far ensured that the project has become more formalized in the schools' annual teaching plans. However, some of the teachers are concerned about the fact that the network is very much dependent on especially the commitment and motivation of the coordinator.

Closer collaboration

Teachers were asked about their interest in closer collaboration with farmers. Laurits from the private urban school in case study 2 explains that he would like to have a closer partnership or agreement with some farms or companies on a more on-going basis. In case study 3, where the agricultural events are primarily at the science centre and in a forest, Bente is also interested in a closer collaboration with different farmers about visits to a poultry -, pork- and cattle farm. This would add to the event days and the school garden activities at science centre. Hanne (the farmer in case study 1) has an on-going collaboration with some teachers in Copenhagen, who take students to her farm each year, however it is not formalized or more than one visit per year.

For most teachers, however, it is difficult to find time and money to go on frequent visits to a farm and thereby have a closer collaboration with a farmer and follow the seasonal changes. Even in case study 3, where the collaboration is close and where the schools have a school garden at the science centre, one of the schools is not able to weed and water the crops on a regular basis, due to its location far from the plot.

Expectations and farmers' role

For most of the teachers interviewed, their expectations of the farm visit were met. They highlight the respect and interest with which most of their students meet the farmers, because the farmers they work with or have visited are interesting experts. According to the teachers, the farmers know how to deal with the students. However, normally it is the teacher's role during a farm visit to keep an eye on the students to ensure that they behave appropriately. The farmer is responsible for the tour and other activities on-farm. According to DAFC, many teachers are likely to be surprised when they realize that it is difficult to find farms in Denmark that are not specialized into one or a few products. For this reason, many of the teachers interviewed mentioned that they would like to be able to also see other types of productions, e.g. another production type or different production methods, i.e. conventional if they only visited an organic farm.

Involvement of parents

In case study 2 and 3, where there is a closer collaboration, but also the teacher with a school garden in case study 1, involving parents has been important. It is important in terms of ensuring that crops are watered during the summer. Parents and grandparents were invited to the harvest

event in case study 3 to see the outcome of the children's school garden activities. The teacher in case study 1 in Copenhagen involved parents in watering the school garden during the summer with the intention of a harvest celebration. However, due to limited maintenance of the garden by the students and parents over the summer vacation, this failed. In case study 2 on the other hand, the parents were very active in the summer period and have greatly supported the project with the organic cooperative farm. These parents were also very interested in organic agriculture and the collaboration with the local cooperative farm. According to teachers and farmers, they have the impression that most children talk vividly about their great experiences on the farm or school garden, when they come home to their parents. Involving parents is important where there is a school garden both for practical reasons but also to ensure support and spreading food and agriculture knowledge to parents.

4.9. Discussion

As mentioned in section 4.6 – 4.7 farmers and teachers have quite different motivations for engaging in collaboration and visits to farms. In the following chapter, I will go more into details with the specific learning goals. Looking at the different sources of motivation, there are clear differences: farmers want to show their production, create transparency and ensure support for their profession or production type, e.g. organic production. It is slightly different with the organic farmers, who also emphasise connecting children to nature. Teachers on the other hand have academic reasons for engaging in agriculture and farm visits, but also a broader focus on shaping children's worldviews, connectedness to food and nature and fostering life skills. Using the outdoor environment around a farm is seen as a great opportunity to combine theory and practice and shaping children's knowledge of where the food comes from. Although the common motivation amongst both farmers and teachers is to show and teach children about where their food is from, this does not mean that they have the same interests, learning goals and criteria for success.

Farmers do not have the same didactic considerations as the teachers do. They focus on children experiencing rural life, farming and learning about their production and where their food is coming from. For obvious reasons, their focus on *how* to communicate this and the academic content is not present to the same extent as it is for teachers. Showing students around their farm can be sufficient in some farmers' eyes, especially in case study 1. Although the farmers had a strong sense of wanting to be show and teach students about agriculture (organic or conventional) and increase transparency to ultimately influence future consumers, for some farmers it is a success for children just to experience a farm and rural life, and the activities on the farm are more about the students seeing the farm, hearing about agriculture from the farmer and having an entertaining day. However, in case studies 2 and 3, where there was a closer collaboration between the teachers and farmers, the farmers were also motivated by giving students an opportunity to connect to the land and nature (case study 2) and transforming education to becoming more experiential and practice oriented (case study 3).

All the farmers interviewed in the case studies had experience with or a strong interest in education and in teaching children about their productions. All but one of the farmers were women, most of them educated and worked part-time as teachers. Yet, when classes come for a visit, they assume the role of farmers first and foremost. Due to limited time on regular farm visits, there was often only time for a tour around the farm and maybe a few activities like sweeping the floor. So although the farmer, Hanne in case study 1 and Anne, one of the organic farmers in case study 2 did have access to some of the more student-driven hands-on exercises and investigations on-farm developed by DAFC and to some extent also OD, none of them used them. Whether this was because of the teachers' needs and a lack of priority and interest in more hands-on student-driven methods is hard to say.

Even though food or rather "knowing where the food is coming from" is a common motivation for both farmers and teachers, farmers might not necessarily focus on food, but rather on their production. A staff from DAFC illustrates this dilemma here:

Ida:"I would like to say that it really surprises me often how little focus farmers have on it.... (unclear)
Interviewer: I'm sorry what?
Ida: the products they produce; that it is food." (Interview with Ida)

Although food is clearly the overarching focus of the teachers, the interviews revealed that farmers focus on details of the production, rather than on the food as such.

The teachers interviewed were as mentioned largely resourceful teachers with an interest in taking their students to farms and prioritized working with food and agriculture in their teaching. The interest, knowledge and competences of the teacher are likely to have a significant impact on their willingness to work with food and agricultural themes by taking his/her students to a farm and otherwise collaborating with a farmer. The survey conducted by DAFC in 2010 showed that 19% of teachers responding knew about the opportunities for farm visits, but had not been on one and another 17% of the respondents did not know about the possibilities at all. The majority of teachers, who do go on a farm visit, found it both fun (22%), educational (22%), and "no trouble" (27%). This suggests that there is both a potential in spreading the knowledge about the possibilities and in developing skills and ideas on how to work with farm visits and agriculture in different subjects.

The survey suggests that responding teachers do see opportunities in integrating farm visits in a number of different subjects. Although most of the teachers interviewed in the case studies teach science, biology and in a few cases also mathematics, Danish and home economics, there are possibilities of including farm visits in these subjects but also subjects like history, geography and social science and in interdisciplinary theme weeks on food, sustainability, environment and health to mention a few. These were some of the additional subjects teachers in the survey highlighted (see annex 4).

Understanding farmers' and teachers' motivation is important for understanding the rationale and overall learning goals, methods and collaboration arrangements. The findings from this chapter showed that the farmers and teachers, who had a stronger and longer-term collaboration also had a strong motivation of making education more experiential, linking theory to practice and giving students new realizations. One of the two farmers involved in one day farm tours (in case study 1 and the organic meat farmer in case study 2) were motivated by the need for children to understand where their food is coming from, increasing transparency and fostering an understanding of agriculture, specifically organic agriculture for one of the farmers. This was also the case for other farmers but there here there was a stronger focus on reaching this goal through a closer and longer collaboration with the teachers. As mentioned in some of the studies presented in Chapter 3, longer-term and multi-component food interventions (field trips to farms, farmers' visits to schools, school gardens and in-class lessons) are important for attaining desired impacts (Evans, Ranjit et al. 2012, Poston, Shoemaker et al. 2005, O'Brien, Shoemaker 2006). For this reason, case studies 2, 3, and 4 and to some extent also the examples in case study 1 are of particular relevance, because they are all tied to either on-going on-farm activities or food and agriculture related activities, experiments and classroom teaching on food and agriculture.

In the following chapter, I will look at the more specific learning goals, behind the overall motivation.

Chapter 5 Learning goals and values in the Danish case studies

In this chapter, the learning goals and values of the different stakeholders will be presented. It is based on an analysis of interviews and educational materials. The analysis will be linked to how the stakeholders integrate learning goals with concrete activities in the classroom and on-farm. Based on these analyses in 5.2, the chapter will tie in the current practice in the four cases with an analysis

of values and whether or not broader aims or values related to food literacy, food citizenship and Education for Sustainable Development are applied in practice (5.3). To do this, the learning goals will be categorised based on an interpretation of interviews and teaching materials, interpretation of values and finally with reflections related to the broader aims of food literacy, food citizenship and ESD in mind.

5.1. Introduction to values and norms in relation to the study

In understanding learning goals and motivation it is of interest to also look at the values behind. But what exactly are values and how is it relevant to this study? It is useful here to draw in Luhmann's perspective on the meaning of values, which is briefly defined as:

"Values are general, individually symbolized perspectives which allow one to prefer certain states or events" (Luhmann 1995) (p. 317).

A value is the difference with which one observes something. It is a preference over something else. Values are therefore *differences* and presupposes a ranking order, i.e. that some actions are more correct or preferred than others, e.g. for some freedom over the preservation of peace (Luhmann 1995). Values become visible through reflection. One needs to compare one's own values with those of others and society. By reflecting on society's values one can organize one's own values. (Wistoft 2009)

A value is also an *attribution* and a more general, individual assessment, which relates to preferences in terms of conditions and events. However, values are often expressed in specific contexts (Luhmann 1995). In this understanding lies a perception about something desirable, which is played out in the choice between different alternatives for action (Wistoft 2009).This could be the choice for an individual whether their general actions are desirable in terms of his/her general values, which e.g. could be about actions being environmentally friendly, fair, healthy, caring etc. This is expressed in specific contexts such as in relation to food or teaching. It is, however, important here to stress that there is a difference between values and norms. Values are constantly changing, whereas norms are values that have become positive habits (Wistoft 2009).

Although values change in society and in individuals over time, a value can also be a *fixed concept* and be linked to codes in the functional system. Any functional system operates through a generalised symbolic medium with a fixed code shaping the functional system (Luhmann 1995, Wistoft 2009). Value codes could be 'true/false' in the scientific system and 'power/non-power' in the political system. A newer value assessment, exemplifying how values change over time and new values emerge, is e.g. the attribution of the food system as being either 'modern/traditional' or 'sustainable/unsustainable' with different perceptions of which is more desirable and what the concept entails.

Values are typically organized in mission/goal statements, ethical codes, religion, and in education in theories and educational ideals. In education, this could be ideals related to student participation, action competence or academic qualifications, but also broader learning goals.

Wistoft (2009) makes a distinction between individual and personal (or social) values. Individual values are connected to consciousness, taste, feelings and beliefs. They are important for a person's learning, as an individual becomes more aware of his/her own values by observing others and oneself and thereby stabilising or changing them and more importantly broadening the complexity of the values. It is important to note that individual values cannot be directly observed by others. Personal values on the other hand are values ascribed through communication. They are a product of communication and ascribed in a social context. However, they cannot be transferred from one person to another and must be actively chosen or created. (Wistoft 2009)

The key concepts of this research - food literacy, action competence, food citizenship and sustainability – are all values, which are connected to broader values related to food, agriculture and nature on the one hand and on the other values related to education. In this chapter, I will take a closer look first at the learning goals, then at what values are behind the learning goals of the teachers and to some extent farmers as well. The main way of investigating learning goals and values will be to look at what is communicated in interviews and educational materials looking at parts (specific statements) and an interpretation of the whole.

5.2. Learning goals

In the following section, the learning goals expressed by the interviewees and in the educational materials will be analysed. When analysing the learning goals, the learning process and methods, content and learning prerequisites will be taken into consideration as well as the framework conditions in terms of the requirements. This is primarily the common goals for different subjects by the Ministry of Children and Education.

As mentioned in chapter 2, learning goals are about being explicit and aware about the purpose of the teaching, highlighting the importance of uniting the goals with appropriate teaching methods, the students' prerequisites and the framework conditions. Thus, learning goals are analysed as either explicit written statement about the purpose of the teaching or oral statements by the teachers and farmers. However, when analysing the learning goals behind various educational materials, where learning goals are not always explicitly stated, the learning goals are interpreted based on the content, learning process and methods used. The analysis includes reflections on the types of learning goals: whether they are cognitive/knowledge goals, positional/affective goals and skill-related goals inspired by Hiim and Hippe (Hiim, Hippe 1997).

5.2.1. Teachers' and farmers' learning goals

All interviewees expressed some overall learning goals behind their involvement in farm-school collaboration and food and agriculture related teaching. It is obviously mostly teachers, who are accountable for their students' learning. Nevertheless the learning goals of farmers and of the interest organization producing many of the teaching materials are also relevant to look at to understand how their learning goals, content and practices related to teaching match those of the teachers.

The categorization of learning goals was done based on an interpretation of educational materials and interviews, which were inspired by the analytical frameworks from chapter 2 (2.4). Based on the categorization of learning goals from the interviews in Nvivo, the following categories were identified:

1. Farm and agricultural knowledge
2. Food knowledge – food literacy
3. Ecological, nature and environmental knowledge
4. Specific academic skills
5. Social skills
6. Life skills
7. Sustainability understanding
8. Action competence

In the following, an analysis of these categories of learning goals will be presented with an elaboration of the more specific meaning and objectives of the teachers.

Farm and agricultural knowledge

"Knowing where their food is coming from" or variations thereof was one of the most common statements from the interviewees as an overall learning goal for the children to learn through food and agriculture teaching, farm visits and other activities. Stine expresses it like this:

"Well they need to understand how much the cows actually mean for us, for our lives here in Denmark, and it has done so for many years, right. Um anything like that - yes they go and buy a steak, but what does it really come from."(Interview with Stine)

The interviews and observations revealed that there were many related and more specific learning goals attached to this overall goal. It was about much more than going to a farm and seeing the cows producing our milk or steak. For both teachers and farmers, giving the students an insight into *agricultural production, the science behind the conditions and choices a farmer makes as well as understanding the importance of agriculture in the Danish society, economy and history* were all important learning goals.

In the case of the teachers working with a conventional farmer in case study 3 through the science network, there was a clear focus on *reaching academic goals of the science subject* in 4th, 5th and 6th grades combined with learning about specific production aspects in agriculture from a science angle to understand the choices a farmer makes better. As Bente explains it:

"That children get an insight into … well what is it with the soil and they get an insight into what a farmer does, and all that he needs to do before he can even put something in the soil. And I think there is an incredible amount of professionalism in it, including also… because now they've been picked at a lot; "but they fertilize too much" and "it flows into our creeks" ... And we have some tests back [at the school] that actually show, well if you apply too much fertilizer, then nothing will simply come up. The plants need only just as much as they can handle. If they get too much the plants die. So then they also get the angle; well they in fact only get what they need. They do not apply too much fertilizer in the soil, because then there would not be any crops. Things like this and that the children also get to see things and also so the children also get to see, well, all these measurements they need to take before they do anything, how far the grain goes down, or the kernel must come down, and how much, how long it actually takes before the grain comes up, how much it really needs to be looked after if they for example did not use pesticides, so they had to go and pick HUGE fields. That they also gain the insight that "well hello, they sort of need to, there are not enough people to hoe all those fields, then we might not earn the money for Denmark, as we should." So then, well, that they sort of get the understanding of the farmers, that they are actually not as bad." (Interview with Bente)

The teacher in other words highlights the importance of qualifying students' understanding of agriculture through their own farming experiences and experiments. In this way students will also get a better understanding of farmers and their decisions. The experiments conducted in the field at the science centre have the goal of not only teaching the students how to grow food, i.e. the process and the challenges, but also of teaching science through experiments. The experiments in the field and back home in the classroom aim to provide students with a more qualified understanding of agriculture, than basing it on myths, which Bente is expressing.

The teachers involved in taking their students to an organic farm (either through a longer process in case study 2 or the short farm visit in case study 4) also have an overall learning goal of the students learning about agriculture. The goal is here to make organic agriculture and ecology concrete but also understanding the differences between organic agricultural production and conventional. Laurits, the teacher with several visits to the organic community explains:

"I think the main aim has been to make the concept of ecology concrete. And make, how do you say, the difference between conventional and organic, what can I say; prepare them to be able to distinguish between the two. But uh we are lacking… how to say… the conventional part is still thin. There is a risk of some delusions, if we do not get a better grip on that part of it. I think. So we of course talked about it, and I've also tried to clarify some differences, but I think it's important that they do not throw conventional agriculture into the doghouse."(Interview with Laurits)

For this teacher, it is key to provide the students with *an objective presentation of agriculture, which does not favour organic agriculture over conventional*. Although he did choose to bring his students to the organic community, where idealism of being 100% organic and as self-sufficient as possible is strong, it seems to have been for pragmatic reason. The community was within biking distance of the school and would enable the students to get a more hands-on experience with growing food - factors which can often be a challenge. This teacher is aware of the fact that the students might become biased towards preferring organic agriculture over conventional agriculture. Yet he and all the other teachers interviewed were not able to take their students both a conventional and organic or to different types of production, except for at the private school in case study 1, where the 8th and 9th graders went on their own to several different farms. Simone in case study 4 approached this learning goal slightly differently: there was a much clearer focus on the students learning about organic agriculture primarily, and only learning about conventional agriculture to understand organic agriculture. With a clear preference for organic food both as a standard for the food provided in the school canteen and as an important value for the teacher, there was a preference for the children to learn about organic agriculture. Both teachers were aware that the farms they had taken the students to were not modern organic farms in the sense that they were community-based or a social enterprise farm, where the business dimension of the farms were not the main priority. This was compensated for by showing the students videos of other organic farmers or conventional production, which were more business-driven. Outweighing the benefits of a more active, practice-based and fun experience at the farm over a more realistic insight into current organic agriculture production was considered by both teachers. Yet for practical reasons and also to get an interesting experience, farms were chosen with an integrated production. Simone explained:

"So basically there was focus on ecology and when we got out there, it was sort of on... Well we were told what it was and ... well it's a little historical at the same time. It's a little old-fashioned at the same time, well […]. Well, it's not like a modern organic farm." (Interview with Simone)

Both farms are not so-called "modern organic farms" mentioned in this quote, which were implicitly understood to be about being specialized, high-tech, professional and business-driven. Instead, the focus on one of the farms is on integrating business-, social and ecological considerations in their enterprise. For the other it is about linking the integrated organic production with self-sufficiency and sustainability principles of the community and provide local organic food to all the members of the community. Both examples are examples of an emerging trend and transition in society towards more socially responsible enterprises and sustainable and resilient communities. However, neither of the teachers mentioned this perspective. Instead there was a tendency to view the farms as *"old-fashioned"* or the farmers as idealistic *"with a clear opinion"* (interviews with Simone and Laurits). This in a sense reflects their views and values related to production of what is the 'right' kind of production, thus neglecting to see these farms from another angle: seeing them as experiments or pioneers in sustainable living, self-reliance and socially responsible and environmentally sustainable enterprise.

Learning about organic agriculture includes learning about pesticides, fertilizers and organic alternatives, reasons for crop rotation and how insects and other parts of the surrounding natural environment on the farm are important for the production. However, it is also linked in the teaching to the children's direct experiences and future role as consumers: including why organic food is more expensive as conventionally produced foods. As Bente working as a teacher in the science network in case study 3 (which does not include field visits to an organic farm) explains:

"They also gain insight into the difference between conventional and organic and I also mention specific issues: what is the difference and why is it that organic products are so much more expensive, and there is a reason for that because they cannot grow so extremely intensive on the soil. So they get that too. And plus they also get all that about pesticides and fertilizers and quality."(Interview with Bente)

These specific aspects were especially important to the organic farmers as a key learning goal. Being able to show and teach the children these parts of the natural cycle and food chain on the farm tour or during a day working in the field was important to the farmers.

Seeing agriculture from a business and professional perspective and framing it within a historical context was common in most of the cases. As Bente explains here:

Bente: "I actually think is important that they find out, well, that there is a reason that we still have agriculture in this country.
Interviewer: And it is important with such an understanding of the profession, that it is important....
Bente: That you take care that they still need to be here. And that Denmark is actually an agricultural country, because we tell - I do at least in my teaching – also tell about how Denmark has become an agricultural country there is the history behind it. From when they cleared the forests to suddenly having small villages, then they needed more fields and in that way suddenly becoming an agricultural country; where people were actually good at it. That they get this story behind it, and to this day can see, well Hey, look what it has developed into." (Interview with Bente)

In this case, the teaching in other words is also linked to the strong historical and cultural roots agriculture has in Danish society. This development is taught to the students by taking them e.g. to an old historical site in the forest to grind flour by hand and cook on a fire. Another teacher SC who did a long teaching on animal husbandry in science and Danish class also time going on a field trip to a conventional dairy farm and to a viking village for her students to learn about current agriculture, how it looked in the past and how it has developed till present day.

The economic and trade issues related to agriculture were also mentioned by several teachers, often in connection with the historical dimension of agriculture having been an important driver in Danish economy and still being important. Bente explains it like this:

"We therefore have huge earnings in Denmark from our agricultural products and we cannot really do without them […]. And that we are still an agricultural country even though we have gradually become a little technical. But we are still regarded as being an agricultural country. I also believe they need to have knowledge about that." (Interview with Bente)

There was a clear tendency to focus on *the historical, cultural, economic, production and consumption related aspects of agriculture*. Most interviewees only mentioned future perspectives and sustainability aspects when asked directly. However, concerns over the future of agriculture in the country, with less and less people directly connected to farming and a diminishing workforce being involved with farming was mentioned several times, such as here:

"We have a generation out there, they have no references to agriculture. Well their parents have not had anything to do with agriculture. And their grandparents are also perhaps the one generation where it tipped, right. So if they have no understanding of what agriculture is and that it is something other than just manure odour and poor working hours. Well, one can say that in the long run, we can experience that agricultural sector will have a hard time finding people. Then plus, it's one of the biggest sectors we have here domestically. So if students do not get to know it, then there is something wrong. So that is why it has been very important that they met the farmer, saw his equipment and his work. So this is also an important part of it." (Interview with Bente)

In other words, *understanding farming as a profession – a future job opportunity - and making this interesting and for the children to see the many facets and aspects of this work*, is something that both some of the teachers and especially the farmers themselves highlight as a learning goal.

Food knowledge – food literacy

Almost all interviewees mentioned the importance of children *knowing where their food comes* from as an important overall learning goal. This is not only about understanding agriculture, as mentioned in the previous section, but also about *understanding food from a farm-to-table and broader perspective*s.

Bente from case study 3 explains it like this:

"That they find out, well, that what they go down and buy in uh Kvickly[xiii]*, it's all something with people behind and there are so many things that need to be done before we can go down and buy it. I think that's quite important that they know where things come from. They actually don't come from Kiwi*[xiv] *or Kvickly. They come from somewhere, and I also think it is reasonably important that they get to know how it's been nursed, or how genuinely it's been cared for that good things come up. Also so they get this health and food knowledge about it and also know, well, the corn I have here, it has been through this whole process before it comes here."* (Interview with Bente)

The colleague, Stine, emphasizes the problem further in this quote and talks about how they transfer the overall learning goal into specific activities:

"They will amongst others work with bread on Monday. Uh ... because kids today just do not have the same knowledge as before. Not even if we think we are doing well in school. But they are not presented to it. Well no-one thinks when they take a pack of minced meat from the counter that there has been a cow out on the field. They do not know it's called a black-spotted cow. They just know it's called a cow. And they're not sure, where this minced meat comes from, actually. And the same with the bread: "the bread that's Schulstad,[xv] *well it'll come from there." They know the commercials but they do not think about, if you ask, what do you get out of oats.... They don't think about that. And that is what we want to encourage them to, and give them knowledge about. All the way from the basics. Well about this Monday we, they actually sow the oats themselves and put the seeds in the ground. Or sow the corn and the potatoes. And we follow it all the way. We go there and hatch and find out what are weeds and what is bad. And at the very end we actually use what we have harvested at our harvest festival. So it is precisely from farm to table, which forms the foundation of everything."* (Interview with Stine)

In addition to this being about understanding the farm-to-table process, it is about:

- *understanding the locality of food and the food system; that some of our food is produced locally and that much of it is also imported and being able to link all this to their daily lives.*

Bente in case study 3 emphasizes this in the following quote:

Bente: *"I in any case would open their eyes to the fact that we cannot do without the farmers. It is like, they find out how many of the farmer's products we use in our daily lives. It is actually so ... and also with corn, just that they get an understanding of the fact ... well, here in Denmark we do not grow sweet corn, because our climate is just not suitable for that, but that we grow a hell of a lot of feed corn. But then we get the corn from another country and we will send ours to another country, so you just swap in that way. So they get this understanding that: what is happening with all of our products here.*
Interviewer: Yeah ok, so the whole imports and exports, and how the whole food system…
Bente: Well yes, not in the student plan, but they get that understanding that there are some things here in Denmark we cannot grow, but that we get it from other countries, but then in return we grow something they can use, and that you also in this way are dependent on farmers doing something, so that we can get some earnings to the country in that area also." (Interview with Bente)

In this quote, there is some emphasis on the students' understanding food from an import-export perspective, although there is not a strong focus on this or seeing food from a food systems and global perspective neither here nor in the other interviews. Similar to case study 3, case study 2 also

has an emphasis on the students understanding the local area and agriculture as an important economic activity for the local area. This local community perspective was also mentioned as an important motivation behind the collaboration between farmers, schools, Coop Denmark OD and the producers' association in chapter 4.

Understanding the many uses of corn and potatoes, which the students in both case study 2 and case study 3 grew themselves and the many food items derived from cows as in the case 1 are examples of this learning goal that students become:

familiar with the many uses of agricultural products.

In case study 3 one of the workshops had a workstation with many different varieties of grain cultivated in Denmark. Although the teacher did not mention it as such, this quote and the previous example are illustrative of how students as part of their food knowledge should:

understand food uses, food diversity or agricultural biodiversity

This is mentioned in this quote:

"Yes, they are also very "Cut it out". Because they only think you can make bread, and you can make flour and you can make oatmeal. That's what they think and if you say corn, then you can make popcorn. That's all they really know, and then all of a sudden when they get there, oh my how they find out that you can make many things. That grain is in fact used in an incredible number of things you eat and in the food. It's like an eye opener for them. Of course we need to have a farmer otherwise we would not have food (laughs)". (Interview with Bente)

The teacher here highlights the limited knowledge many students have about the many uses of different plants (and in other cases, other agricultural products). Activities like the one in case study 3 can open the students' eyes to the many different uses of e.g. different grains and corn etc. The importance of farmers and agriculture is again mentioned by this teacher here. There is an emphasis here on the importance of supporting and justifying agriculture and farmers to ensure our future food supply. This is in fact also the underlying rationale and objective of farmers and DAFC. This is done by highlighting the opportunities in the agricultural profession but also the key role of farmers in ensuring that we all have food to eat.

Although the farm-to-table process was mentioned to be a key learning goal, and integrated especially in case study 3 and by the two schools connected to case study 2, it is a challenge for the teachers. Although these are examples of how the children grow their own potatoes, corn or wheat etc. and that they also cook with their home-grown crops, the actual steps in food chain are a challenge to convey to the students. Due to time and financial constraints, none of the teachers were able to take their students on visits to a slaughterhouse, a dairy or other processing facilities to get a direct experience of how for example milk is turned into other products. Sometimes students

experienced that a dairy truck came to the farm during the visit to pick up milk. Teachers mentioned compensating for the lack of time to go on more field trips, by finding videos on YouTube to illustrate the farm-to-table process to their students. The farm-to-table process in other words tended to focus on the farm AND table process, with very little emphasis on the steps in between or the international dimension.

In addition to understanding the many uses of foods and varieties of crops, the teachers also mentioned the importance of:

understanding food quality, health and nutritional aspects.

The case studies 2 and 3 had this as important dimensions of the teaching. Bente explains this learning goal:

"What is the difference and why is it that organic products are so much more expensive, and it's there for a reason because they cannot grow as intensively on the soil. So they get that too. And plus they also get all this about pesticides and fertilizers and quality. Food quality; what's that. What's good and what's not. So they sort of get around it that way and think. And you can also draw the diet into it, you can also use a subject like digestion, and what it is people do or the body in general, you can also include. Well there are many, many things you can include, when they first get an understanding of food quality and growing and then...." (Interview with Bente)

Apart from teaching about food quality, nutrition and health in the classroom and experiments, which Laurits mentions, the teachers also included *cooking* and healthy lunch and breakfast activities in the school to learn hands-on about health and nutrition. In a workstation during one the science and agriculture events in case study 3, there were tastings of different types of bread and group work to taste, detect content and quality of the different types including white and whole grain breads. An exercise of reading posters and finding the answers to ten questions about food quality and nutrition was also included here integrating reading, writing and comprehension aspects into the learning goals as well.

Some of the teachers in case study 1, 2 and 3 have integrated cooking exercises into the teaching. The teacher in case study 1 from the Copenhagen school joined a school garden programme in Copenhagen, where the children helped slaughter a chicken before cooking it. Although cooking activities were included in many of the teaching programs, none of the teachers mentioned this to be a specific learning goal. This has likely to do with the fact that none of them except one were teaching home economics.

When asked directly about the concept food literacy, it often the ***origins of food and the production, which had the main focus***. This could be due to the fact that all but one of the teachers taught science-related subjects. The quote below from Sanne illustrates quite well this point:

"Interviewer: What would you say has been sort of the most important to you? Has it been, has it been to sort of get an understanding of food or is it more the agricultural understanding ... uh … or is it more..?
Sanne: (pause) ...It is probably MOSTLY the understanding of food. Where does our food actually come from, right! […].What should you do to be a farmer? What, how to take care of animal, right. How much does it actually require?" (Interview with Sanne)

Understanding where the food is coming from and about agricultural production is in other words central both as the overall learning goals and in the teacher's understanding of food literacy. However, for the teachers in case study 3, there was a broader understanding of the term food literacy, illustrated with this quote:

Interviewer:" Is food literacy a word you so think about for this course or?
Bente: Yeah uh. I actually THINK about it a lot, including that they know where the things come from and that they think about the process and about the fact that there are actually some people that ensure that it tastes good […]. And then plus the food literacy [bildung] that is about you not saying "ew" when you meet something and that you think well that the body must have something to live on, and that it should be evenly distributed, or percentage distribution between fat and carbohydrates and proteins and....That they know a little about that too. That they know that you all must have a balanced diet for the body to live on, because it hungers for the food there and you have to treat this body well, so that we do not just say ;"I only like rice" or "I will only have rice". "So that they know that it's just not good enough. The body simply cannot live on them becoming food literate - also in that way. Plus everything with vegetables and all.
Interviewer: I think actually also that in all the different parts of your teaching, there you also get around the different angles there, of what you can actually call food literacy.
Bente: Well clearly. We have in any case planned that, plus they also when they come to Kjællinghøl[xvi]*; how do you processes to all the things? How do you harvest the things? And what do you then do and what you can make out of it? And we thought that should also be included. And then we talk about it before we go down and we always do some preparatory work before we go on these events, for example when we go to Kjællinghøl. That we then talk about what you can do and how to cook it and touch on issues about, what it is the body needs and what not to eat too much of, and if you do what you have to do with exercise and all that."* (Interview with Bente)

This teacher in other words has a more comprehensive and well defined understanding of food literacy than the former, which reveals that food literacy is in fact at the core of what the teachers aim to accomplish in case study 3. Enhancing the students' science skills and knowledge about agriculture is part of this, but food literacy and to some extent agricultural literacy is the overall goal. Derived from this quote and previous quotes, food literacy so far includes the following dimensions:

- ***Knowing where the food comes from***
- ***Knowing about and gaining skills related to the food process (including***

growing, harvesting, processing, preparing/cooking and other processes not mentioned here)

- ***Developing courage to try new foods***
- ***Having manners when eating***
- ***Knowing about nutrition and what constitutes a balanced diet***
- ***Knowing about the many uses of food crops/items***
- ***Knowing about health and physical activity through food***

In case study 4, there was also a strong focus on developing food literacy amongst the students. With the school being an all-day 'food school', where organic food is provided in the canteen involving students in the cooking process, food is high on the agenda. The school has a high percentage of students from ethnic minority families, where healthy eating habits are often a challenge. This offers opportunities in both developing the students' cooking skills, courage to try more and new foods, including local, organic, seasonal vegetables and integrating it into the teaching. The fact that Simone teaches both home economics and science facilitates this integration, as she is both in the kitchen with the students, in the classroom and present when the students went on a field trip to the organic farm. It enables students *to learn how to cook but also learn which vegetables are in season* and discuss if they have been grown in Denmark or elsewhere. Simone explains this here:

Simone: "So there might have been 2-3 kg of meat in each pot, as the basis for an entire school. Then, it was simply supplemented with vegetables. There were LOADS of vegetables, but it was cooked so much together. But they eat it. I also think it's kind of interesting the thing about when you produce it yourself.
Interviewer: Yes that they taste some things that they might not have otherwise
Simone: Then compared to what they would otherwise get at home, there're also sales in the canteen [a shop]. I think that is very nice to see. And they get that understanding of what kinds of greens there are in Denmark at this time of year." (Interview with Simone)

The interview with Simone, who primarily teaches ethnic minority students, was held in February. For her the fact that the students would eat some of the traditional Danish winter root crops like parsnips and beetroot largely replacing meat was quite an accomplishment, considering they are not used to this at home. These were crops the students had seen while visiting the organic farm and could therefore remember them, when using them in the stew mentioned above.

Although it was not a key learning goal, the activities in case study 3 also aimed to teach children about wild foods. During one of the workshops, an important part of the activities was to teach children about the *abundance of food in nature and raising their awareness and taste of wild plants/foods*. This has become increasingly popular due to the attention of the renowned restaurant Noma and new Nordic Food diet on wild plants. With the guidance of a nature guide, students were shown how to find edible plants in a forest, which they cooked on a fire, making wild berry jam and stinging nettle soup. Bente talks about the activities:

Bente: "Nettles and things like that ... But we prepare everything we can find out there. It is cooked and processed, and then they get it to eat and get to taste it all and finish it at the end. So we gather all the kids and do (indistinct)
Interviewer: Well, that's great. That the food is also included and that you discover that you actually could go out and find food in the wild. One does not need to be down at the super ...
Bente: No you do not need to go to KIWI[xvii] *always. One can easily do out there."* (Interview with Bente)

Bente is here talking about how wild foods are prepared during the event day in a forest and eaten by students towards the end. From the observation of the harvest event day, students were clearly not used to identifying and collecting wild plants. The nature guide was eager to teach and encourage the children to learn about 5-10 different plants. The students responded that they do not believe they can. During the forest walk, the nature guide passed a parking lot with a few cars. The students were able to identify the brands of the cars within minutes, after which the nature guide responded:

"Then you can also do it with plants in nature. Imagine if you could just identify 5-10 so you could go out and pick them yourself, cook and didn't need to buy food in a supermarket wrapped in plastic." (Observation of nature guide)

Also students participating in the activities at the organic community farm in case study 2 collected wild foods and made dandelion and stinging nettle pancakes on a bonfire.

The subjects, which the case studies take their departure from (i.e. science and biology primarily), do not have the farm-to-table perspective written in the ministerial learning goals. Instead it is one of the main learning goals of home economics. (Undervisningsministeriet (Ministry of Education) 2009, Undervisningsministeriet (Ministry of Education) 2009, Undervisningsministeriet (Ministry of Education) 2009) Nevertheless this is the overall aim for the teachers (and farmers), although other learning goals are also important, as mentioned here. Food and agricultural literacy are the overall learning goals – focusing on knowing how food is produced and where - and with more specific goals and academic skills under the broader umbrella of food and agricultural literacy.

Ecological, nature and environmental knowledge and appreciation

Knowing about ecology and nature is also an important learning goal, which was mentioned specifically by those teachers taking their students to organic farms and working with organic agriculture in the teaching. This was also an important learning goal for the organic farmers too but also some conventional farmers mentioned this to be an important learning goal and can be summarized as:

- ***Understanding light, photosynthesis, natural/nutrient cycles, food chains, role of flora and fauna, soil, groundwater, seepage of pesticides and nitrogen oxides and related issues.***

The overall learning goal here can be categorized as *ecological and nature knowledge*.

In addition, ***animal welfare and respect for nature*** is also an important aspect covered by most farmers and teachers. It is about:

- ***Understanding how nature works, how farmers use the natural cycle and resources in the production, how important the different components of the cycle are and teaching children respect for nature (including insects, worms and livestock)*** are all components of this learning goal.

This learning goal, along with most other learning goals mentioned, has a strong cognitive focus. However, the second part about teaching respect for nature is an affective learning, which some farmers and teachers mentioned a visit to a farm interacting with farm animals and insects etc. is highly effective at.

Teachers did not mention it directly, but the organic farmers especially mentioned the importance of teaching students respect for nature and to connect to nature, from which most children are removed. The organic farmer, Anne, explains that when children understand that worms and bees are important for the soil and pollination, the initial fear or disgust with which children often react tends to disappear. Another farmer, Inge explains it here:

"There is simply such a change from when they come out here, when they start out here, and think it's disgusting and might trample on insects once they get here. It changes completely during those few hours they are here. They get such a great, great different…. That's in any case my experience. And I can only speak from that. They get a respect for things… which they can… respect for animals and insects […] They get a completely different..." (Interview with Inge)

The farm visit, even a half day one, can according to this farm open up a respect amongst the students' for nature. Understanding the connectedness in nature is also something that is highlighted by the organic farmers. Anne describes this learning goal here:

"So they get an understanding of why there is such an interaction. I think that's really, really good that they experience it. That in fact… that it all interacts. And if you pull out the sprayer and spray these aphids away, well there is also a lot of other small insects that die. It's not very good for the good insects. Or they die … well too, and the microorganisms in the soil, also do not like pesticides. And that allows me to say… well because it's a fact. And that's what's nice about me being a farmer and not a teacher. I can ... I do not have to be neutral." (Interview with Anne)

Inge elaborates on the learning goal:

"Well I think that it's about the fact that it is all connected. That it is. What you do has an impact on so many other things. So it is about ripples in the water, and it is important that you relate to it and that it is IMPORTANT that you relate to that down at the supermarket" (Interview with Inge).

General and specific academic skills

Most teachers combined the overall cognitive learning goals already mentioned with more general and specific cognitive and skills-based academic learning goals.

- ***Having a fundamental understanding of science, nature, environment and agriculture***

In most of the cases, such as case study 2 and 3, an important goal was to give the students a fundamental understanding of science, nature and agriculture. This could give them basic understanding and skills on which to draw later in their education. The fact that the teachers in the three schools in case study 3 worked across 4^{th}, 5^{th} and 6^{th} grades and also included teachers that teach biology in 7^{th} grades and up makes it easier to draw on this basic understanding of agriculture and nature later on.

- ***Understanding key scientific concepts and processes (e.g. in ecology)***

Working with some key theoretical concepts through practice such as ecology, nutrient cycle, pH value, nitrate etc. was highlighted by the teachers as fundamental for students to learn these rather complex concepts. They are an important foundation for their future education. Several teachers had the perception that working with complex theoretical concepts in practice and seeing where their food is produced is something that their students will remember in the future. Learning that there is a theory behind everything and how theory and practice relate was also mentioned by one of the teachers as being important.

- ***Conceptual and language comprehension and skills***

In terms of agricultural literacy, understanding basic words and concepts such as 'crop', 'silage' and different names and types of crops, farm equipment, and livestock is part of this agricultural knowledge. Farmers and some of the education materials paid a lot of attention to teaching children for instance that a cow is not just a cow, but that there are several different breeds and that there are different terms such as 'calf,' 'heifer,' 'bull' etc. This not only strengthens the children's understanding of the complexity in agriculture and nature and of different concepts to strengthen their language comprehension. Some of the teachers also linked the teaching and science experiments related to agriculture with an understanding of the body both of people but also of the livestock, e.g. cows and pigs.

- ***Understanding issues from an interdisciplinary perspective***

Working with agriculture, food and farm visits was carried out in an interdisciplinary manner and several teachers mentioned that they drew in other disciplines in their teaching, e.g. Danish language, mathematics, geography and as already mentioned home economics. It was not mentioned directly as a learning goal, but implicitly this could be teaching students to view a topic from different angles/disciplines.

- ***Having general academic skills***

There were also a number of general academic skills, which were mostly implicit and sometimes explicitly mentioned. These included reading and comprehension skills, group work, skills in conducting science experiments etc. For instance as one teacher stressed that the students understand that they have to read instructions or a background/manual before doing an exercise or experiment. SS with a lot bilingual students in case study 4 used the texts about organic farming developed by OD in two different levels of difficulty, to strength her students' reading comprehension and differentiate her teaching. Learning to understand complex theoretical concepts through hands-on activities and appreciating the link between theory and practice was another point stressed by several teachers.

All teachers worked in one way or another on strengthening their students' collaboration skills by working in groups, either on-farm and/or back in the classroom. The rural school in case study 1 with an agricultural theme in the 8th and 9th grades, had the agricultural thematic project as a project to teach the students how to work in groups, write research questions and work problem-based. For this teacher, the agricultural theme and learning related to that was secondary to learning goals about how to work problem-based, working out a research question, doing interviews, analysing, presenting and communicating findings to others.

Social skills

Several teachers (and also a few farmers) mentioned promoting students' social skills as a benefit of single farm visits and especially of the longer collaboration. For the teacher Annette in case study 2 developing her students' social skills was her primary learning goal. The teacher explained that the purpose of having a school garden at the organic community farm was not to integrate the experiences in the field into the teaching in the classroom. Rather it was for her to promote the well-being and sense of community in her class and develop interpersonal relations between the children. Learning about growing food and about organic agriculture was also important but secondary or a means to the overall social learning goal. Later in the process, as the class was given the opportunity for more funded visits to the farm, the academic focus and learning about organic farming received higher attention learning wise.

In case study 3, where there was strong emphasis on developing students' food literacy, agricultural literacy and academic skills, the social dimension was also an important learning goal. Bente illustrates this learning goal and related learning well:

"That they come out amongst other children and need to deal with other adults to teach them. And they must behave in a house, which they - well they know it by now - but that is a different place than what they are used to. And I also think that as a teacher, you can pull back a little, and then you can sort of stand and observe and see completely different sides of the kids. Plus it is about them venturing out into some situations where they do not know in advance what it is we need to do ... They know they need to run around to different work stations and try a lot of different things related to agriculture but we do not say directly in this work station, you need to do such and such and such […]. They are told that when they get out there to also have an element of surprise. Also to see how exactly they respond. And also the thing about interacting with others. How you behave when there are many people in one place. And then you do not yell and scream, and you are kind to other children and you do not laugh at them. And you listen when adults speak. So all that training you have to go through too I think. That one must be able to interact in other places than one's usual surroundings." (Interview with Bente)

There are normally more than 100 children and teachers during an event day, and the social interactions and learning related to this is in other words important. Not only Bente stressed this point but also other teachers from the school mentioned the social interactions, relations and cooperation competencies as being important learning goals. To sum up, the learning goals are about

- ***The capacity to interact and work with others***
- ***The ability venture out of one's comfort zone and into new situations***
- ***Manners and ability to treat other humans kindly***

Life skills or 'bildung'

Several teachers have mentioned what can be termed as life skills – which are linked to social skills and broader bildung. The ability to interact with others and approach and handle new situations was just mentioned above, and can be seen as part of life skills. However, life skills are broader, and UNICEF defines them as:

"Psychosocial abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life. They are loosely grouped into three broad categories of skills: cognitive skills for analysing and using information, personal skills for developing personal agency and managing oneself, and inter-personal skills for communicating and interacting effectively with others." (UNICEF 2003)

UNESCO (2001) further elaborates on this definition to also include *reflective skills*. From this angle it is about abilities that help negotiate, think critically, solve problems and make independent

decisions. This is closely linked to the concept of bildung, which was introduced in the theoretical framework in chapter 2. Bildung is about stimulating and qualifying students to become future citizens, who can make sound judgements, think critically and act independently, and who can and will play an active role in society. Furthermore, it is also about developing the student's self-determination, co-determination and capacity for solidarity (Klafki 2001).

One of the teachers, Sanne, mentioned that a goal for her was for her students to get a deeper understanding of the world and how things work, which can stay with them later on in life. This appears to both be linked to both cognitive learning goals and also skills to understand the world, oneself in it and also to analyse information and contexts. The farm visit and garden-based experiences, however, focus on both these cognitive and skills aspects of learning about oneself and the world, but just as important on the affective and multi-sensory learning of caring about the world.

As mentioned above, critical thinking is an important part of bildung and of UNESCO's definition of life skills. Several teachers mentioned that they work actively with ***promoting their students' critical thinking and forming their own opinions as an underlying learning goal*** for their farm-school activities. In the case studies this is promoted through working with critical thinking and opinions e.g. in relation to forming opinions about conventional agriculture and organic agriculture. They also include this by working with different articles and sources, where the students have to analyse and investigate who wrote the article and consider why the authors write as they do. That students learn to ***ask questions and question what they are told*** is something Bente focuses on in her teaching. However, she mentioned that working with critical thinking and source criticism can be more challenging in the lower grades, but still included it although it is easier to work with when students are older.

Simone from a school with a lot of ethnic diversity in case study 4 explains that she sees the learning goal of developing food literacy as part of a broader agenda of developing life skills (or bildung). She highlights that she sees food as a means of developing students' life skills and discuss values. She goes on to talking about the how the exposure to new kinds of food is also enhancing their willingness to taste new things that they are not used to. Simone draws in how she works with and focuses on critical thinking and forming opinions.

"I have also talked a lot about sort of views and opinions and what it means to have an opinion. Well ... there are some who have difficulty with this. But it also has something to do with multi-lingualism […] and culture" (Interview with Simone).

The teacher teaches students from mostly other cultures than the Danish, which is reflected in the above statement. She links the development of critical thinking to something concrete: food and the understanding of conventional and organic agriculture. In the process of developing her students' critical thinking and formation of opinions she stresses the importance of basing these opinions on concrete knowledge. The teaching, which has included a farm visit, videos and other learning

materials, has helped this learning process of discussing and developing opinions amongst the students. In her understanding of reflective skills, she links it to citizenship and teaching her students about rights and obligations within society and about being an active part of the community. This can be a challenge in a multi-ethnic classroom both to understand rights and obligations but also of shifting the students' focus to forming and discussing their own opinions instead of asking the teacher's opinion. Simone ties this to what was mentioned above about explicitly working with and discussing values in the classroom. Forming opinions and values is, however, a long-term process, as Simone explains:

"Just to go home and disagree with their parents; that's probably enough in itself. So I think more in terms of it being attitudes towards one's OWN adulthood. It builds. We help create, no." (Interview with Simone)

Working explicitly with values with the children in the classroom is also linked to this overall learning goal of developing life skills. In a sense it can encompass ***the cognitive skills (accessing, analysing and using knowledge), reflective skills (thinking critically and making decisions based on one's values), personal skills (developing personal agency to express oneself and one's values) and inter-personal/social skills (for communicating and interacting with others e.g. determining what is right or wrong behaviour)*** guided by one's values. Food can be a platform for this development of life skills and teaching citizenship.

Action competence and citizenship

Action competence is linked to life skills but goes further. It is a key term and educational goal in education research. As defined in chapter 2, action competence is about 'knowledge', 'action experiences', 'involvement' and 'co-determination' (Elmose 2007). Thus, it goes beyond life skills. The combination of commitment, action experience and knowledge is essential here. The emphasis on action competence is about working with positive visions and concrete actions to ultimately develop responsible and action-minded future citizens (Breiting, Hedegaard et al. 2009). Thus, it is about developing students' ability, motivation and desire to play an active role in democratic solutions.

Action competence did not have a strong emphasis as a learning goal across all the cases and amongst all the teachers. Nevertheless, for a few teachers action competence did appear as an underlying learning goal in their teaching. Following the points made above about life skills, Simone from case study 4 works explicitly to promote her students' knowledge and experience with forming their own opinions. The next step is for students to take action and responsibility from the knowledge and opinions they have developed. Simone in fact takes her focus and learning goals in the direction towards action competence as well:

Simone: "I also believe that the more students get to know me, and the more, well also the everyday talk, the recognition that the person gives you, you become an educated person. It is not… Now I'm

not talking about formal education and stuff like that. But about a formed person who does good in this world. And organics is a large part of it. Just having a POSITION ... so that you don't simply destroy society completely into pieces.
Interviewer: What about something like actions or action competence? Well one thing is about views, but there is something...
Simone: Yes and then of course it is… it is also that you can act on it at some point. (Laughs) […]. But I think somehow that if you get some views, you get some input, then I also think you get action competence additionally from that. Well somebody who is just told "this is society", well then it will continue to be that way. But if you also try to help ... well how society ALSO could be ... a bit like that, right. Then I believe; we must believe in those dear children. That the more present you also are … then it doesn't matter that I'm the teacher. But the more present you are, and the more you also, well now it is also bilingual children, but also that fact that they…. Well I never talk about Turks or Pakistanis, right. Because it is part of my everyday life. And if you sort of spread that out to the society so that they too… there are not many who expect "well uh Turks, they are people who do not eat organic". Well ... I think the attitude is like that a little. But if you could like spread it out, without being a fanatic." (Interview with Simone)

Simone is here talking about giving her ethnic students' trust and knowledge about organic agriculture and food, seeing them in fact as future change agents. The school where she works, unites learning about organic agriculture and food with the supply of organic food in the school canteen and involving the students in the actual cooking of the meals. The school is in other words presenting the students with healthy and sustainable actions and alternatives than what they are used to from home: in the school kitchen but also working with organic food, agriculture and health as well as citizenship actively in the teaching. This whole-school approach is often highlighted as being an important approach to promoting health and environmental awareness and actions, as it combines the knowledge part with concrete actions and involvement, which is seen as a key to bringing about commitment amongst students – all of which are important in fostering action competence. Simone mentions that she combines the knowledge about organic food and agriculture with the students' development of opinions while working with alternatives to the present situation. All these factors are important within a pedagogy that focuses on action competence as the overall goal. Developing knowledge and views, however, is not enough: action experiences and students' involvement are critical as well.

Another teacher Laurits in case study 2 doing the school gardening at the organic community farm mentions explicitly action competence as an underlying goal of the different topics he covers in science. It is not only relevant for his food and agriculture teaching, but is used as the underlying ideal, which is reflected in his approach to teaching in general, although he has not yet integrated it into all areas of his teaching. Till now he has spent time with his students' blogging with another school. He has done this with a shorter project on light looking into cancer and sunbathing, but would like to do it on ecology, organic food and animal welfare. The purpose is for the students;

- ***to get experience in communicating views and participating in democracy e.g.***

concerning organic food and animal welfare through social media and other platforms.

The purpose is to use their new knowledge to form opinions and communicate this to others. In case study 1, the 8th and 9th grades do this through an agricultural fair for the rest of the students and by writing to the Minister of Agriculture. Laurits would like to encourage his students to do this too, e.g. through a blog, to get them to reflect and act when for instance deciding:

Laurits: "Does it matter to me whether, if the meat I put my teeth into is produced in a certain way, the choices I make when I stand at the meat counter, what is it based on?", "It's not me who buys food at home, but if it were now"..." When I stand besides mom or dad and put my hand into the counter, I have an opinion about it." I think it would be interesting to work that way.
Interviewer: But it's not something you've done yet?
Laurits: No, we have tried to blog and I see it as a good… I think it is a good means for this kind of work." (Interview with Laurits)

Laurits stresses that blogging with another school requires that both schools have to be prepared and have developed a process. He ties the blogging approach to the new form of democratization, which finds its outlet on the internet through participation on blogs, where people let their voices be heard, but also on TV during debates, where people's views are presented in the subtitles during the debate. It is these kinds of action experiences, which LB plans to link to his science teaching in the future, to also add an underlying action competence and democratization perspective to the science teaching. Laurits explains:

Laurits: "I think we have a duty to prepare them for having some form of action competence. So being able to communicate about such things.
Interviewer: So would you say that also in the future it is an important goal for you… well with the teaching?
Laurits: It is in any case something I am aware of ... and I think, I believe that that part should become clearer the older they get, well in the higher grades […]. Well if I uh think democracy, then I think it would be a question of whether or not one has action competence and can participate in the democracy and it can be that if you have ideas and opinions and can communicate them. Well. Well then I'm thinking that must be the overarching goal of it all. That we like.... It is probably also in the purpose of the public school that it is.... designed to ...
Interviewer: Well it does. Yes definitely
Laurits: Participation in democracy. So if you lift it to that level, then I think it must be that. And, it is made concrete by them working with a blog, I think, based on the knowledge they have. But also that they engage in dialogue with an organic farmer in a field. Well ... it's also to test it out; I myself have some opinions." (Interview with Laurits)

The focus on working with and developing opinions is already a learning goal, which Laurits acknowledges and which the students are experiencing in their interactions with the farmers. The farmers at the organic community have very strong opinions about organic agriculture and lifestyle.

Some of students on the other hand had asked why they should buy organic foods, when it's more expensive. The teacher saw this as a sign of critical thinking and an invitation from the students to get the farmers to come up with some good arguments. Capturing these moments as a teacher was something Laurits saw as important. Critical thinking was in other words an underlying learning goal for this teacher in addition to the more specific academic learning goals related to understanding organic agriculture, ecology and theory in science classes. Only focusing on developing critical thinking without a focus on action experiences, involvement and co-determination is more linked to life skills and bildung as overall learning goals.

The other schools, such as the ones in case study 3 and the local school in case study 2, have extensive teaching programs, but none of the teachers tie in the democratic and action competence perspective as an underlying goal. This could be due to the fact that the students are young. Laurits' class was a 6th and later 7th grade class, whereas the other students from case study 2 and 3 were from 3rd to 6th grade.

The rural private school in case study 1 works with the agricultural theme to develop the 8th and 9th graders' skills in research and project work as well as their reflective capacity and communication skills. Teachers and students also incorporated some of the action competence principles. The students' independent projects on different aspects of agriculture, including their own research and ideas, included not only critical thinking and reflections they also worked with and presented different opinions and conflicts of interest. This was mostly about presenting conflicting views on organic agriculture and conventional agriculture and presenting what the students' own opinions were about this. One group also had interviewed different stakeholders about a land use law restricting cultivation near water sources. The views of farmers, wildlife- and environmental protection groups and the Minister of Food and Agriculture were presented. This group had successfully written to the Minister to get her views on this issue. Another group worked with developing future visions for agriculture looking into technology and land ownership issues. From observations of the students' project presentations, interviews with the students and review of their project logbooks, it was quite clear that the students were interested and committed to work with agriculture independently. They could choose their own angle when working with the agricultural theme based on their interest. They interviewed farmers and unveiled different opinions and were able to communicate with a minister, which seemed very motivating for the students and ensured an ownership of the process. Their presentations at the end also revealed that they had formed their own opinions based on the different views they found through their research process. Interestingly the students had different views on organic and conventional agriculture, and captured many key points. The process of being exposed to different opinions is important: not just for inspiring and shaping their own opinions but also for developing an understanding and respect for the opinions of others.

Sustainability understanding

The concept of sustainability and the principles of Education for Sustainable Development were not concepts or principles, which the teachers used in their teaching. As mentioned in the introduction,

sustainability and sustainable development is about understanding and reconciling environmental, economic and social dimensions of development, ensuring equity between generations and populations and a transition towards resource conserving production and consumption. ESD principles are about promoting this change; working with power relations, conflicting interests, dilemmas, empathy, promoting reflective learning and future visions, different development paths, explorative experiences and actions to promote sustainable change.

None of the teachers mentioned sustainability or sustainable development, when asked about their learning goals or content of the teaching. It was only when asked directly that some of them mentioned aspects of it. Some of them said straight out either that they were not working with the concepts, because they were too difficult for the children to comprehend, or that they introduced the concept after 7th grade. For some teachers, sustainability and sustainable development were challenging concepts to work with, because they themselves were not very familiar with it, so they found it challenging to introduce to their students. Simone found it rather difficult for these reasons and when asked about how she sees the term, she explained:

Simone: "It depends on whether or not we think the same about sustainability (laughs) No but ... In my world, it's that it can just run around. A cycle or the ecological cycle or natural cycle. That it weighs each other out. Isn't that correctly understood?
Interviewer: well, well it can mean many things, but it includes amongst others this aspect with the ecological cycle that it...
Simone: that it must not get anything from the outside." (Interview with Simone)

This reflects a rather narrow understanding of sustainability; to only focus on the environmental dimension and seeing it as a cycle that does not evolve with inputs from outside. It therefore becomes difficult to work with the concept, when it is not well understood by the teacher.

Laurits mentions that it is difficult to work with but that he is slowly introducing the concept:

Laurits: "I think it is such a difficult concept to grasp, or grasping. I will say this; that when we talk about pesticides or herbicides, or when we talk about ground water that is clean, etc., then it's actually part of the sustainability idea or concept. Uh so I think we have put the pieces to the great puzzle of the concept with what we have done here. I have not introduced it as such. Well I have used the concept but I do not think they have much to relate it to yet. So I guess I think that it is ahead, I would actually like that it is like an umbrella that comes in later in fact.
Interviewer: I also think that it ....at least in social studies.... in 8th-9th classes I think it is in the common learning goals. It is also included in home economics.
Laurits: But it may also be included, but you can use it in the conversation with the kids more or less uh well ... because otherwise it can easily become a very empty term that you throw around. Oh, and perhaps, as you introduce ... well you can get a wrong angle on it. I don't know. It is important that they are ready to receive those very large concepts […]. And I think we have added,

have included some important pieces to the concept with what we've done." (Interview with Laurits)

In spite the difficulty here of introducing the concept to his 6th graders (later 7th graders), it is slowly being introduced during the teaching and field visits to the organic community farm. Although the community and the representatives working with students in fact encompass and talk about many practical initiatives to live sustainably, including being almost self-sufficient with electricity from solar energy, low-energy housing, compost toilets, recycling of rain water and having their own farm, the teacher does not include these other dimensions into his teaching and mentions that his students do not seem to really take all this in very well. It does not seem to be due to the fact that the teacher is not aware of or have ideas about working with the concept of sustainability later on. Rather it seems to be other priorities and lack of ideas about how to introduce this complex concept to the 6th graders. Laurits has ideas about how he could work with sustainability and sustainable development in the future, e.g. in the 7th grade:

"But I think if we need to address it at some point, where we say we're having, an integrated understanding of sustainability, then it could for example be that we follow a product from cradle to grave. That we for example follow uh… what is it called; that we for example follow the production of, what is it called, a Danish farm pig, a pig completely all the way to throwing out the packaging. And where does it go? It could be an interesting. .... It could almost.... it could be.....an annual teaching plan for a 7th grade to work with." (Interview with Laurits)

Laurits is planning to do a life-cycle perspective when working with sustainability; by following one product. This is similar to his teaching about (organic) agriculture through the example of a potato, which the students learned about from farm-to-fork. The risk, however, is that sustainability and sustainable development is not addressed from a holistic, systems and current and future generation perspectives. This would imply that in working with e.g. the life-cycle of a pig (which Laurits suggested) future perspectives related to environmental impacts of pig production, fodder and water for pigs, rainforest impacts, transport issues and long-term inter-generational impacts of meat production should be included.

Although Laurits has not followed the life-cycle approach or sustainability issues in his teaching about organic agriculture where he focused on potatoes, he has tried to include different angles related to the potato: cultivation, processing, the supermarket as well as environmental and ecological issues in agricultural production such as pesticides, seepage, groundwater, nutrient cycles etc.

Bente from the science network in case study 3 has a comprehensive understanding of sustainability and does not express any challenges in working with the concept. However, it is not included as a perspective in the teaching within the science network in the 4th – 6th grades. Instead is it included by Bente in her teaching in 7th grade, where she covers in detail the differences between organic and

conventional agriculture, fair trade and international issues in agriculture to mention a few. She explains here:

Interviewer: "When working with sustainability in 7th grade are you, is it primarily in the environmental or are you also looking at other areas of sustainability? Well for instance the social? Bente: Well I look very much at both the environmental but also at the working conditions and the condition such as them not depleting the soil, and that they can manage without subsidies at some point, etc. So I get all the way around. Both the human and the economic and also the environmental, and wildlife for that matter could also be brought into it […]. So it's all the way around in the 7th grade." (Interview with Bente)

Many of the teachers tend to work with agriculture from a historical and cultural perspective, where the technological development is an important part. Very few include a future perspective. In fact the only example that was mentioned directly about looking into the future of agriculture was at the rural private school in case study 1. Here the school focuses on providing students with skills relevant for an unpredictable future and empowering students to become democratic, critical citizens with knowledge of the world and tools for changing the world in the direction they desire, as stated on the school's website. In the relation to the food and agriculture theme the students worked on, one of the 8th and 9th grade groups did their project on future farming. Another group investigated conventional farming and organic farming from the perspective of which of the two was more sustainable from a future perspective. Through interviews and visits to conventional and organic farmers, the students reflected on the different arguments, presented them to the school and finalized the debate with their own recommendations for the future. Issues like price, labour intensity, food security and environmental impacts and resource use were discussed by the students from a future perspective. They concluded the debate pointing out that it will and should still be possible to have organic and conventional products in the future. They included points about organic livestock having better conditions than conventional ones, and that this has an impact on the price of conventional products being cheaper. The students appealed to their peers and teachers to think about their consumption, as it has an impact. These presentations and the students' logbooks revealed a great sense of understanding, reflective skills, commitment and independence in working with agricultural issues.

An important principle in ESD is about working with future visioning. The fact that most teachers work with agriculture from a historical and contemporary perspective almost entirely could have to do with the fact that most of the teachers interviewed here were teaching 3rd-6th graders. Here the focus tends to be on the children getting a fundamental understanding about agriculture and food and the historical roots and development first. Sanne mentioned, however, that she has worked with visioning in other areas than in relation to the food and agriculture. She had a theme on the 'future school', where the students had to envision what they would like the school to look like in the future and the kind of world that they would like to live in. This is as mentioned an important principle in ESD. Sanne, however, found it to be a challenge, because it was difficult to get the children to think out of the box and think of alternatives to their present reality:

"Well, they don't have so many visions […]. Few have, they are the incredibly resourceful and can make all sorts of exciting and good ideas, right […]. Some real Einstein types." (Interview with Sanne)

Although this teacher has difficulties in getting her students to work with visions, it is nevertheless an important tool for developing students' creativity, innovation and for them to think about and co-create their own futures. Apart from Sanne, none of the other teachers worked with future visions. Several teachers included indirectly perspectives on critical thinking and indirectly conflicting views on organic and conventional agriculture. This was done either through teacher-lead class discussions, movies with debates afterwards or through what teacher Stine from case study 3 described as a role play, where the students more actively had to argue for a particular view. Also this teacher stressed the fact that the agricultural theme in the science network activities was too big to also include a sustainability dimension for which reason this was not being emphasized. Stine stressed that there is not much focus on sustainability and sustainable development in relation to agriculture in educational materials. Rather it is included in other subjects and themes in 7th grade and up, e.g. in relation to water, waste and energy use.

To sum up, there was a tendency for most of the teachers to acknowledge that sustainable development and sustainability is an important issue, but that it was too complex to add to an already compressed teaching or that it was a perspective that was more relevant and easily understood amongst older students 7th grade an up. In addition it was also mentioned in the context of other broader issues or in connection with e.g. water and energy.

An exception to these perceptions and practice was found with the school and teacher near the organic community in case study 2. The 3rd grade teacher, Annette, had been on the organic farm in the community more than 10 times during the school year, and had treated this as a way of strengthening the social atmosphere and competencies in the class. Nevertheless she and the school were later very engaged in a thematic week on sustainable development, where food, energy, consumption and other aspects were included as activities during the week-long teaching for all the students at the school on sustainable development. During that week sustainability and sustainable development challenges were illustrated to the children by doing different activities to learn about resource scarcity and what they can do themselves to change and adapt to this reality. They watched a video about a man who made the transition from being an average consumer to changing his lifestyle into a more resource-conserving one. This gave rise to critical reflections on how far one should go to save resources and Annette's 3rd graders had a discussion about this in class. To her it was not a challenge to work with sustainability and sustainable development issues with her 3rd graders. Her main challenge was to find educational materials on these topics. In talking to her, she revealed a good understanding of sustainable development, which she saw as being about reduced resource use, alternative lifestyle and the future. She stressed the importance of focusing on positive future-oriented narratives about sustainable development to the children, and not negative doomsday prophecies, which might scare the children. Annette highlighted the importance of the

social dimension, which is often overlooked. In this case it was about strengthening the sense of community in the classroom. The main focus was on the local dimension of sustainable development and the children got a chance to visit the organic community to learn more about their initiatives and ways of living sustainably, not just related to food. The focus was on local initiatives and the global dimension was not included apart from the profit from sales of recycled products being donated to a project in Africa. Even in this 3rd grade, the teacher talked about food in relation to sustainability, drawing on their experiences from the organic farm. Issues like local food being more sustainable due to less transport and that organic food is more sustainable due to lower resource/input use were discussed. According to Annette, they had had some good discussions and the children revealed a rather reflective and critical angle on food and sustainability in spite of their young age. These experiences from the 3rd grade teacher in other words contradict what appears to be lack of experience by the other teachers in teaching about sustainable development in the lower grades.

The farmers did not include any direct points or learning goals related to informing the students about sustainability issues, neither during observations nor in the interviews, at least not amongst the conventional farmers but amongst the organic farmers. The conventional farmers did, however, have opinions and points about sustainability issues when asked directly. One farmer, Hanne, tried to teach the children to not throw waste in nature, which could harm livestock and other animals, pointing out the importance of children understanding that the trash might be picked up and eaten by an animal; in other words promoting more the environmental perspective and awareness. Another farmer, ES mentioned that he does include sustainability perspectives when he works with children, but without using the actual term. Like some of the teachers, he also feels that the term is too complex to convey to the students. He revealed a narrow environmental understanding of sustainability; here understood in terms of its environmental and ecological dimension, of how the components within the natural cycle interacts and impact each other. The farmer highlighted the complex scientific perspectives of sustainability as an argument for it being too complex for the students in primary even secondary school to understand. Instead he mentioned that the farm-to-table perspective was more easily conveyed to the students.

The farmer, Karen, mentions that for her it is also important to tell children about the food chain, and to highlight that on her farm they produce their own fodder for the pigs. She stresses the importance of telling older students (not the 4th graders) that the fodder is locally produced, not shipped from Brazil producing CO2, and to include working conditions and salary into the picture. The conventional farmers interviewed said they do consider environmental perspectives when talking to the students. Yet during farm visit observations and in most of the educational materials, this was not mentioned at all. A stronger and more holistic teaching on sustainability and sustainable development issues is found with the organic farmers, who included these perspectives during farm visits/visits to the organic community, in educational materials and when interviewed.

The organic farmers tend to focus more on presenting sustainability issues to the students. The farmers working and living at the organic farm and sustainable community integrate broader issues

in their teaching about living in a community, where sustainable living solutions are such an integrated and fundamental part of the community. They talk about and show their solar panels, rainwater collection system for the washing machines, the alternative building materials on their houses, especially to the older children. Many students are also interested in learning about how the community and farm works socially; who makes decisions and how can so many people live together, which is very different from what they are used to at home. An important learning goal for these farmers is for the students to understand that all things are connected both in the farming system and in the broader food system and society: 1) that in organic production all components are important including livestock, vegetables and grain production, and 2) that what you do and what you buy has an impact somewhere else in the system. They urge students to think about this when they shop for food too. They highlight the importance of producing their own food to avoid transportation and environmental impacts associated with that. The organic farmers use the term sustainability, especially with the older students, but stress the importance of being critical towards the concept, as it is often misused, especially in the context of something being economically sustainable.

5.2.2. Content and learning goals in the educational materials

As with the learning goals of teachers and farmers, the content and learning goals found in the various educational materials from amongst other DAFC and OD and the producers' association are also focusing on farm and agricultural knowledge as well as food knowledge (food literacy), with understanding the farm-to-table process as a cross-cutting issue. Many of the written materials followed this pattern of content and implicit cognitive learning goals: illustrating and understanding the farm-to-table process and for students to be able to link this to their own daily practices. Some of the same categories as the eight identified from the interviews are also present in the educational materials. Social skills and life skills are not explicitly mentioned or implicitly like they were in the interviews. For this reason, these categories have not been included here. In the following, the same categories will be elaborated with new specific goals from the educational materials.

Farm and agricultural knowledge

- ***To understand the farm to table process, including the different steps along the food chain***

This was the key cross-cutting learning goal in nearly all the materials. This was mainly in the form of either videos showing how e.g. milk is extracted from the cow, picked up by the dairy truck, transported to the dairy, made into milk and yoghurt etc., ending up in the supermarket. Another method was to include photos with text or exercises/cards with the steps in the farm-to-table process, which the children themselves had to order correctly. The videos especially enable the viewer to get a glimpse of a dairy or slaughterhouse, which most children and adults do not normally have access to. As mentioned, none of the teachers had time to take the students to a farm and to a dairy or slaughterhouse. The videos and visual books and online resources can compensate

for this. Only few interviewees focused on the understanding of farm-to-table processes from a global food systems perspective and how broader global, economic and societal issues impact agriculture, food and diets. This will be treated as a separate category shortly.

In addition to understanding the farm-to-table (e.g. cow-to-milk, grain-to-bread or pig-to-pork) process, nearly all the written materials and most of the films, included cognitive learning goals related to understanding the agricultural production process:

- ***To understand different primary production methods and conditions including information about conventional, free-range and organic production, conditions in the stable, feed and feeding practices, etc.***
- ***To understand animal behaviour and nature, anatomy and life-cycle and life cycle of plants***
- ***To understand different varieties, breeds and uses of livestock, crops and other agricultural products.***
- ***To understand soil including, soil composition, fertilization and other factors***
- ***To gain an understanding of the agricultural profession and life on the farm*** (especially in the videos). (see Annex 2 and 3)

Some educational materials related to agricultural production, also included more skills-based and affective learning goals:

- ***To develop hands-on skills and interest in growing their own food*** (Case study 3 materials);
  (Keller 2009).

In addition to these production related learning goals, some of the educational materials also included a learning goal related to broader issues in the agricultural sector:

- ***To gain an understanding of the food and agricultural sector, including its importance for the economy and the stakeholders and stakeholder interests*** (Foreningen Økologiske Skolegårde 2013, Dansk Slagtefjerkræ 2007, Coop Skolekontakt 2012) (see also Annex 2 and 3).

- ***To gain an understanding of historical factors – including societal and technological development - and its influences on the Danish food and agricultural sector***. (Dansk Slagtefjerkræ 2007, Danmarks Radio (Denmark's Radio) N/A, Coop Skolekontakt 2012) (see also Annex 2 and 3).

The latter was also a learning goal present in many of the educational materials including some old movies about agriculture in the 1940s and 1960s.

Food knowledge – food literacy

Under the overall category of food literacy and knowledge, the following learning goals were identified from the educational materials:

- ***To be able to understand food and develop skills and interest in sensing, handling (food hygiene), using, producing and cooking different foods***, including:
    - getting a sensory understanding of food and being able to develop language skills related to food and tastes. (see Annex 2, e.g.: http://skole.lf.dk/Laeremidler/Vare?product=spis-min-gris; http://skole.lf.dk/Laeremidler/Vare?product=ost; http://skole.lf.dk/Laeremidler/Vare?product=smor-og-anvendelse-af-maelkefedt; http://skole.lf.dk/Laeremidler/Vare?product=maelk-og-syrnede-maelkeprodukter; http://skole.lf.dk/Laeremidler/Vare?product=bakterier-i-din-hverdag; case study 3 educational materials) (Laursen 2007, Keller 2009)

This learning goal combines both cognitive and skills-based objectives, but also affective learning goals, when appealing to the senses, experience and motivation of the students.

As with some of the interviewees, many of the educational materials include a strong conscious consumer perspective related to food literacy, summed up in this learning goal:

- ***To develop awareness and reflective and critical skills of future consumers***, including:
    - an understanding of different production methods, animal welfare conditions, labelling, nutritional and hygiene
    - an understanding of their own role and impact as a consumer. (See annex 2 for details, e.g.: http://skole.lf.dk/Laeremidler/Vare?product=vild-med-kylling; http://skole.lf.dk/Laeremidler/Vare?product=den-kritiske-forbruger; http://skole.lf.dk/Laeremidler/Vare?product=dyrevelfaerd; http://okologiiskolen.dk/undervisning/indskoling/; http://okologiiskolen.dk/undervisning/mellemtrin/; case studies 2 and 3 with own educational materials)

This learning goal is, however, also part of several of the previous learning goals related to understanding the production but adds the emphasis on critical and reflective skills, where information is assessed critically focusing on the students forming their own opinions and ways of acting on the information. This overlaps with the learning goal on action competence, which, however, goes beyond the individual consumer focus related to food choice to include a broader democratic and citizenship perspective. Thus, for the sake of clarity, the consumer oriented learning goal has been included here under food literacy and later the broader food citizenship perspective will be addressed in connection with action competence.

Another learning goal is:

- ***To gain insight into the conditions and connections between health, diets, environment and ethics*** including:
    - ***To reflect on your own impact on climate conditions and other environmental impacts through one's food choices***. (Dansk Slagtefjerkræ 2007, Coop Skolekontakt 2012, Økologisk Råd (Danish Ecological Council) 2013) (see Annex 2 for more details).

The ethical dimensions and the interconnections between diets, health, environment and ethics have not been mentioned by any of the interviewees. This is, however, an important aspect of being a conscious consumer and highlighted in two of the teaching materials related to conscious consumption. This goal is about understanding the relationship between working conditions of the producers, fair trade conditions and animal welfare, environmental impact and the price of food. The insight into these relationships does not explicitly mention the importance of *understanding a product's true price*. However, understanding the connections between these factors could be linked to an understanding of actual costs of production, which takes into consideration the environmental, social and health related costs of products.

Some of the educational materials integrate aspects of ethical considerations and cost of production. The booklet with exercises 'The Critical Consumer' (Dansk Slagtefjerkræ 2007) by DAFC focuses on the ethical dimension from an animal welfare perspective. It urges students to investigate opinions by different stakeholders and considerations about how to treat livestock. It also focuses on students gaining an understanding of the interrelation between price and the type of production conditions (e.g. organic, free-range, caged and conventional chickens) and forming their own opinions. This take on ethical dimensions is not surprisingly focusing on Danish farmers' and other stakeholders and their views and considerations. Coop Denmark on the other hand, who has developed the educational materials on 'The Product Leaves a Trail/Footprint' (Varen Sætter et Fodspor) (Coop Skolekontakt 2012) focus on the working conditions of workers in developing countries and child labour, and how the demand for cheap products has negative impacts on humans and the environment and the ethical dilemmas related to that. Coop Denmark's materials are one of the few teaching materials found, which have this international angle related to fair trade and working conditions. DAFC used to have an on-line game for 7^{th}-10^{th} grade students and up related to the critical consumer, which tied in dilemmas related to working conditions in developing countries, fair trade and transport issues of food. However, at the time of writing, this was no-longer available on their website.

Climate change issues related to food are not present in any of the current educational materials from neither DAFC nor OD in spite of its significant importance. A pixi book[xviii] on facts about modern farming by DAFC mentions briefly some environmental impacts of agriculture and the environmental protection initiatives by the agricultural sector in Denmark. All other teaching materials related to pork, cattle, chicken, dairy and egg production mention nothing or very few points about environmental impacts and nothing about climate impacts; this in spite of the

significant greenhouse gas emissions from agricultural production globally specifically meat and dairy production. There is no mention of climate change, greenhouse gas emission from agriculture or any of the existing initiatives by the agricultural sector in Denmark to reduce emissions. Part of the explanation for this is likely to be the fact that some of the teaching materials are targeting younger children (grades K-6th grades), where a more basic understanding and skills are in focus. Another explanation could be the fact that many of the materials emphasize an understanding of the production and understanding the agricultural sector, which in Denmark is significantly reliant on animal production. Increasing the awareness of the impact of the animal production on the environment and climate change is not in the interest of the agricultural interest organizations, since much of the focus of climate friendly food initiatives focus on reducing meat consumption.

The EMU educational portal and Coop Denmark school service have several materials on climate and food issues. It is, however, not found under agriculture and food and is not easily accessible. At EMU's website there is a link to the Ecological Council's booklet and movie on "Meat Wisely" (Kød med Omtanke) (Økologisk Råd 2011). The material is about the growing meat production and consumption globally and especially in Denmark and the implications for the environment, nature, climate and global food availability and access are raised. It includes perspectives on how to handle this challenge individually, technologically and politically through the way we farm animals, use technology, politically regulate production and eat as consumers. Thus it implicitly deals with sustainability. Combined with this booklet, the Ecological Council has made a movie showing different consumers' attitude towards meat and vegetarianism and some of the challenges and solutions are discussed. At the Ecological Council's website, more resources are available related to food, production and environmental impacts to raise children's awareness of how the food they eat and the production behind impact the environment. A booklet called "We Share the Ocean" ("Vi Deler et Hav" by the Ecological Council) (Skovbøl 2013) tells the story of how food production especially meat production impacts the environment, focusing on the run-off from livestock production and its impact on waterways, oceans and fish. Sustainable production methods in agriculture and fishing are presented in the story to avoid and mitigate pollution from livestock production. This material gives important insights into environmental impacts of meat production and consumption. The question, however, is how accessible it is to teachers.

After compiling and analysing the data, EMU restructured and updated their website with more educational booklets, guidelines films and activities on climate friendly foods, reducing food waste, GMOs, reading food labels, Nordic and wild foods and global food consumption developed by various projects, municipalities and interest organizations. These were, however, not included in this analysis or used by the teachers interviewed.

Although materials do exist on ethical dimensions including climate change and considerations of farmers and workers in other countries, which have an implicit sustainability perspective, the teachers interviewed did not include this as a perspective in their teaching. They did not use any of the teaching materials with a climate change, ethical or sustainability perspective. The main ethical perspective present was about animal welfare and organic vs. conventional production. This is

likely to be due to the fact that teachers work with these perspectives in higher grades and that some teachers are not familiar with teaching about sustainable development and sustainability.

A learning goal, which was not was not addressed by any of the interviewees except for one farmer (Karen), but was found in a few of the educational materials was about:

- ***Understanding the global food system and societal impacts on agriculture, food and diets***

Although farm-to-table perspectives were a key objective, none of the teachers worked explicitly with globalization of the food supply. One of the teaching materials addressing the global dimension and social (and environmental) impacts of agriculture, is DAFC's the Critical Consumer (made by Danish Poultry producers under DAFC). The learning goals of this material are for students in 8th grade and up:

- ***To be able to understand and give examples of how everyday life in different types of societies are influenced by globalization***
- ***To be able to account for values and norms and argue for one's own opinions***
- ***To be able to discuss and reflect on issues related to food security, animal welfare and environment – locally, nationally and globally*** (Dansk Slagtefjerkræ 2007).

Interestingly, this educational material has an explicit focus on values and arguing for one's own views. The learning goals related to globalization are made concrete in the content and activities by addressing and understanding such issues as different production systems (conventional and organic agriculture), food security challenges, agriculture in EU including EU policy and its impacts and the pros and cons of globalization in terms of competition and import/export of food. The methods of teaching are partly to read, investigate further and discuss issues in class thereby working with values and opinions. Shedding light and understanding on the globalized food system is, however, not included as a perspective here.

None of the teachers interviewed mentioned the global food system as a perspective they included in the teaching, even when talking about farm-to-table issues. The farm-to-table perspective was very much oriented towards the short supply chain, i.e. understanding the farm-to-table perspective in a local Danish context, e.g. of one product. The farmers, on the other hand, had a broader outlook and did mention import and competition issues. Grasping the global food system is, however, also a challenge for most consumers including teachers. Very little educational material is available, even in the 7th-10th grades. An exception was found on EMU's educational portal, where a movie on the global food system was illustrated through a short animation movie about a fish. EMU has links to eight short films about climate issues of which one is about our global food system and food miles. A Fish's Long Journey (En Fisks Lange Rejse) (Dreyer 2009) is an animation film about a fish's more than 40,000 km journey from the North Sea, through Germany, Holland, all the day to China where it is filleted, and back to France, where it is turned into a fish stick and returned to the Danish fisherman's plate. In a tragicomic way, the problem of food miles and CO2 emissions from the

transport of fish and many other foods across the world is illustrated to raise children's awareness of the many kilometres, counties and processes our foods have been through on its way to our plates**.**

Ecological, nature and environmental knowledge and appreciation

An important learning goal in some of the educational materials, primarily by the OD and the producers' association of Organic Schoolyards, was:

- ***To gain an understanding and appreciation of nature and ecology, including understanding natural cycles and food chains***. (see e.g. Annex 2 for details or directly at: http://okologiiskolen.dk/undervisning/mellemtrin/ http://okologiiskolen.dk/undervisning/overbygning-nyt/natur-pa-okobrug/; http://okologiiskolen.dk/undervisning/overbygning-nyt/okologi-og-livsstil/) (Laursen 2007, Keller 2009)

These cognitive and affective learning goals of understanding and appreciating nature were at the core both of the teaching materials but also the farm-based activities on the organic farms. This is even more emphasised as a core objective of the school garden programs Gardens for Bellies (Haver til Maver) and Copenhagen School gardens. This overall learning goal includes:

- ***To understand key concepts within agriculture, ecology and sustainability***
- ***To gain an understanding of all parts of a plant and different types of plants we eat***
- ***To be able to relate these broader concepts to daily life and the types of plants we eat.***
- ***To gain an understanding of and interest in food, plants, nature and science using all the senses.***
- ***To develop a connectedness to and curiosity about nature.***

It is in many cases combined with food growing, cooking and nutrition, e.g. in the educational books developed about the Gardens for Bellies school garden program, thus integrating skills-based learning goals with the more cognitive and affective learning goals:

- ***To gain skills and interest in growing and cooking your own food***
- ***To gain experience and inspiration to cook healthy meals using nature, organic- and local products.***

Especially the activities and educational resources developed for the Gardens for Bellies school garden program combine the understanding of and connectedness to nature in their learning goals and activities with the child gaining an understanding of his/her own body, food consumption and health. The aim is to bring about a holistic understanding of the connections between nature, body, health and spirit. (Laursen 2007)

General academic skills

In most of the written educational materials, there is a reference to some of the broader educational

objectives mentioned in the Common Goals documents for various subjects by the Ministry of Children and Education. Some of the specific teaching materials used, however, also have some key academic skills as key skills-based learning goals. This has been summed up as:

- ***To be able to plan and carry out observations, investigations and experiments.***
- ***To be able to collect, structure and communicate results and experiences in different ways and to different audiences.***
- ***To be able to gain practical experiences with theoretical concepts and scientific teams and processes***. (Case study 2 and 3; http://skole.lf.dk/Laeremidler/Vare?product=ost; http://skole.lf.dk/Laeremidler/Vare?product=smor-og-anvendelse-af-maelkefedt)

These learning goals were especially pronounced in the educational materials developed by or for case studies 2 and 3. Furthermore, the books and booklets developed for the Gardens for Bellies program and some of the educational materials by DAFC e.g. on milk and cheese included many student experiments. The experiments and general included were linked to both agriculture and food knowledge.

Action competence and citizenship

Action competence and citizenship are learning goals, which are found in several of the educational materials targeting students from 7th grade and up. This is very much about giving the students experience, encouraging them to form opinions and values and providing them with a sense of empowerment that their actions and opinions matter:

- ***To form one's own opinion, values and action competence***
- ***To be able to place the daily actions of others and oneself in a societal perspective.***
- ***To shape a personal value base to form opinions and develop an interest in influencing societal conditions***. (Coop Skolekontakt 2012, Dansk Slagtefjerkræ 2007)

Again here there is an important link between forming opinions and developing one's personal value base. Both educational resources referred to here have a strong focus on action competence and citizenship. Goals of action competence and citizenship differ from goals of critical consumption mentioned earlier in the sense that it goes beyond the focus on seeing the individual as a consumer to seeing the individual as a citizen: a citizen who acts through the consumption choices AND other choices and actions he/she makes. This could for instance be about trying to influence political decisions, mobilizing and forming community groups or deciding to grow your own food, which some of the experiential teaching activities in the cases and educational materials could foster later on. Growing your own food and engaging in community and political activities goes beyond reducing the individual to a consumer, who can make only healthy and sustainable choices through his/her food purchases and consumption. The values of the individual and sense empowerment, or 'Locus of control', are critical factors for action. Locus of control is the individual's perception of whether he/she has the ability to influence change through own actions. (Kollmuss, Agyeman 2002)

In addition to these two examples, where the learning goals of action competence and citizenship are mentioned more explicitly, the goal of encouraging students to form their own opinions is also essential in the educational materials by the OA. For instance it is part of some of the goals and activities in the OA organic food and farming modules where the students relate food and farming to their own lives and develop ideas and visions for the future of farming and a school café (http://okologiiskolen.dk/undervisning/mellemtrin/;http://okologiiskolen.dk/undervisning/overbygning-nyt/okologi-og-livsstil/)

The importance of joint action and student participation is important here too, although this was not mentioned as a learning goal directly in any of the educational materials reviewed, except in OA's material for 7th-10th graders mentioned above, where they were asked to develop their own future café. The objective behind this exercise was to build students' sense of involvement and participation. (http://okologiiskolen.dk/undervisning/overbygning-nyt/okologi-og-livsstil/ interview with Breiting)

Sustainability understanding

Similar to the interviewees, sustainability is not a term widely present in the educational materials either. A few exceptions are the resources found on EMU's and Ecological Council's website, Coop Denmark's booklet "The Product Leaves a Trail" and in some of the teaching materials from OD. The learning goal related to sustainability very much has to do with understanding the concept and making it concrete:

- ***To be able to understand the concept of sustainability and sustainable development and relate it to your daily life.***
- ***To be able to critically analyse and form opinions about living sustainably including understanding the possibilities nature and technology offer for a more sustainable and humane production, consumption and waste handling***. (see Annex 2 and 3, e.g. http://okologiiskolen.dk/undervisning/overbygning-nyt/okologi-og-livsstil/; DR Skole, En Dansker Bliver Bæredygtig) (Coop Skolekontakt 2012, Økologisk Råd 2011, Skovbøl 2013)

The short movie on DR Skole about what a Danish man does to live sustainably is an example of how sustainability is made concrete and relevant for the children's daily lives. This was a movie that was shown to the students in 3rd grade during the thematic week on sustainable development in case study 2. Although his actions are considered by the teacher and students to be a bit extreme, it was a good movie to show to get the students to think and discuss their current life style and how to live more sustainably.

In addition to the resources referred to here, EMU has an interdisciplinary theme on Education for Sustainable Development. There is a wealth of educational resources in a number of subjects (science, geography, mathematics, home economics, social science etc.) and thematic areas such as

nature and biodiversity, chemicals, waste, water, energy, transport, cities, developing and developed countries as well as food. These provide additional examples of how students can work with sustainability in relation to food by e.g. reducing food waste, eating Nordic and local foods and eating climate friendly.
(see http://www.emu.dk/gsk/miljoe/inspiration/Mad%20og%20klima/Mad_og_klima.html; http://www.videnomenergi.dk/Leksikon/Smart-energi--koekken-kost-og-klima/Spil--klimavenlig-mad.aspx)

There are also additional ideas and principles for teachers to work with sustainable development from links to projects across Denmark for inspiration and reports on Education for Sustainable Development by researchers at the Department of Education's Centre for Research in Education and Pedagogy, Aarhus University. (Breiting, Kaspersen et al. 2011, Breiting, Schnack 2009)

Food is only one area amongst many, where sustainability and sustainable development perspectives are integrated. Although there are many examples from concrete initiatives in different schools for inspiration, only a few teaching materials e.g. booklets address concepts of sustainability and sustainable development in relation to food except the ones mentioned above.

In addition to the practical examples of activities and the teaching materials, where sustainability is mentioned in relation to food, EMU also has links to a report on how to work with sustainability and sustainable development in teachers' education (Breiting, Kaspersen et al. 2011).

5.2.3. Overall assessment of the educational materials

What characterizes nearly all the educational materials is that they are developed by or for interest organization, ranging from DAFC representing farmers and food industries, organic farmers and food business in OD (and later primarily organic farmers in the producers' association), consumers and retailers in Coop Denmark, Aarstiderne, a food company, who owns the Gardens for Bellies school garden program to the Ecological Council, an environmental NGO working towards sustainable solutions. None of the materials were developed without any ties to a particular interest. Although the EMU portal also has educational materials collected and organized in different topics and under different subjects and grade level, the teaching resources found related to food and farming are primarily by DAFC. A more thorough search found links to educational materials of other interest organizations with a stronger environmental and food profile, than the agricultural interest of DAFC. This includes the selected materials from companies like Coop Denmark and Aarstiderne and the NGO, Ecological Council. However, all the resources represent special interests. Not surprisingly, there is a strong tendency in the educational materials by DAFC to focus on understanding production, OD to focus on organic agriculture and the Ecological Council on fostering an understanding of the environmental impacts of agriculture. Issues like the climate impact of food and sustainability of the food system are thus left out by the DAFC and OD.

The materials on the EMU website have been organized based on grade levels, subjects and themes relevant for each subject. Under Nature/technology (science), there are themes related to farm animals, but no broader theme on food and agriculture. Under home economics, there are several themes related to food and even some materials related to sustainability (local Nordic foods and school gardens), but nothing related to agriculture except topics of ecological farming, but with the link not working. At the timing of writing, the EMU website had just been updated with more themes. However, not with many additional and new educational resources related to food and agriculture except for resources on school gardens and Nordic foods.

Interdisciplinary themes can also be found, e.g. related to climate-friendly foods, but the way the links are organized, it is not easy to find the resources. Unless a teacher is specifically looking for and spends time searching for perspectives related to climate and environmental impacts, sustainability issues and other issues related to food, these perspectives are difficult to find. The fact that these more interdisciplinary and critical angles on food and agriculture are somewhat scattered on the website, could mean that the teachers do not include these angles unless they are actively looking for these perspectives. Few teachers mentioned sustainability issues in relation to food and agriculture could be linked to this challenge.

Only few teachers focused directly on environmental or global dimensions, apart from the teacher Bente in case study 3, the conventional pig farmer Karen and the farmers on organic farms did include some perspective related to ecology and the environment. Except for some statements related to import and export of food, few teachers focused on or used materials aimed at fostering an understanding of the global food system. Most teachers presumably know little about the global food system, although they have an interest in teaching about farm-to-table issues. The global dimensions are complex and presumably just as incomprehensible to the teachers as they are to students.

Several teachers mentioned (when asked directly) that they work with sustainability issues in the higher grades, i.e. in grades 7 and up, but in relation to other areas and sectors than food (e.g. water, waste or energy) (e.g. Bente in case study 3). Annette and colleagues as mentioned organized a thematic week on sustainable development. She had difficulties finding teaching materials for her 4th graders on sustainable development and especially in relation to food.

Teachers' opinions about the educational materials available were rather mixed. Some liked the fact that they could use different modules and skip within the modules, as they can with the materials by OD and later the producers' association for Organic Schoolyards. One teacher found this material to be too old-fashioned in its didactic approach and layout with small questions-and-answers exercises and simple drawings. Another teacher praised the fact that the educational materials from DAFC were informative and with technical details. Many used the materials to supplement other materials they had found or developed, which revealed a great sense of commitment and autonomy by the teachers. The materials from OD were developed so that teachers and students could go through different modules step-by-step, however, most of the teachers using OA's materials did not follow it

from start to finish, but selected different parts of it to use. Both OD's Organics in Schools and DAFC's Class in the Stable included materials to be used before and after the farm visit. However, farmers reported that several teachers did not prepare their class beforehand and several farmers did not use the more interactive student-exercises on-farm, which DAFC's materials were based on. There are in other words several challenges in terms of the access to and use of the educational materials.

Although DAFC focuses on production aspects (including historical perspectives) and farm-to-table understanding of food, there is a realization that more emphasis on sustainability aspects and future dimensions of agriculture is important. A current DAFC campaign in the media has an emphasis on the future of agriculture and sustainability. Interviews with DAFC staff revealed an interest in a stronger focus on these perspectives in future teaching materials. A realization by DAFC that some of their materials had too much of a historical angle, has lead them to remove some materials from their website. To follow the focus of the rest of DAFC, there was an interest in a stronger focus on future dimensions, ESD and visions related to agriculture.

The categories of learning goals covered in the teaching materials and teaching have also to be assessed based on the age and grade level of the students. Understanding the learning prerequisites of the students (e.g. age) is essential for understanding the choices related to learning goals, content and methods. It is clear from the interviews and analysis of learning materials, that the focus on agriculture and food production aspects and farm-to-table perspectives are very much learning goals, which are dominant for the lower grades (1^{st} through 6^{th} grades). The same applies to the learning goals related to ecological, nature and environmental knowledge and appreciation. Although there is also some emphasis on these learning goals in the higher grades, most of the educational materials with these learning goals, are targeting 1^{st}-6^{th} grade. The food knowledge and literacy learning goals tend to be concentrated around the 4^{th}-6^{th} grades and up, with an increasing emphasis on critical thinking, global dimensions of food, food citizenship and action competence related learning goals in the highest grades (7^{th}-10^{th} grades). (See annex 2)

Understanding the concept of sustainability and how to live sustainably are learning goals which, although present in the Common Goals by the Ministry of Children and Education already after 4^{th} grade and up in home economics and 2^{nd} grade in Nature/technology (science), are not mentioned by the teachers and to a limited degree present in the teaching materials. Teaching materials and the practice by teachers show that sustainability and ESD perspectives are mostly present in the teaching from 7^{th} grade and up. With the exception of the whole school thematic week on sustainable development in case study 2, the rest of the materials and teachers leave sustainability perspectives to higher grades, and integrate it into biology, social science, home economics subjects in these grades. Several teachers point out that it is a difficult concept to work with and that the teaching in the lower grades related to agriculture, ecology and food can prepare the students for working with this term in the higher grades.

However, although the term is challenging for students in the lower grades to understand, there are ways of making the essential dimensions of the term concrete for students even in the lower and middle grades. A report on ESD teaching in Danish schools by Breiting and Schnack (2009) and interview with Breiting show that it is possible to introduce ESD thinking to students in as low as 3rd grade (Breiting, Schnack 2009). In this case, the ESD perspectives were made concrete by having the children work with understanding differences in living conditions and future development opportunities for respectively a child in Denmark and in Guatemala. Working with the children's imagination and empathy by getting them to imagine and identify with a Guatemalan child and his future grandchildren, was one way of making the dimension of inter- and intra-generational equity very concrete to the students. Dolls were used for the children to imagine their future grandchildren and drawings for them to visualize what they would look like. The teacher would use storyline pedagogy in the form of a timeline to bring the future into the classroom and get students to reflect on whether or not certain decisions would be acceptable to their grandchildren. This example shows that it is possible to include concrete dimensions related to sustainable development in the teaching in as low as 3rd grade, getting students to understand and reflect on future needs and the needs or others. The focus, however, is not on getting the students to worry about the future. Rather it is for them to understand that there are many different future paths, that they can engage in solutions to present challenges and that their involvement matters, with the aim of developing mental ownership, self-confidence, motivation and action competence. (Breiting, Schnack 2009)

5.2.4. Linkages between practice and the Common Goals by the Ministry of Children and Education

The mission statement for elementary education in Denmark states that the goal of education should be for students to gain knowledge and skills to prepare them for further education, and to provide them with an understanding of human interaction with nature and foster a multifaceted development for the individual student. Furthermore, it states that elementary education should provide methods and conditions for experiences and immersion to enable students to develop consciousness and confidence about their own opportunities and a background for forming opinions and acting. It should prepare students to understand their rights and obligations and how to participate in and take responsibility for being a citizen in a democratic society (Ministeriet for Børn og Undervisning (Ministry of Children and Education) 2013). Thus, it captures many of the overall goals, which mentioned as more specific learning goals by the teachers.

The food and agriculture education, which is represented in the four case studies, provide teaching where various methods mentioned above are used and conditions in place to provide the students with knowledge, skills and an eagerness to learn by working with real life experiences, experiments and immersion into the field of food, which is relevant for the daily lives of the students and future citizens. The food and agricultural teaching to varying degree in the different cases provides opportunities to develop students' life skills, give experiences with forming opinions and in a few cases also to gain insight into the democracy in Danish society.

DAFC and OD have gone through efforts to link the content of the educational materials including the farm visits to the educational goals and standards for various subjects by the Ministry of Children and Education. These goals and standards are currently under revision by the Ministry, for which reason the goals from 2009 will be referred to. Although there is a focus on many broader aspects like providing the children with social skills, life skills and food literacy, the agricultural related learning goals of the teachers are closely interlinked with these academic requirements related to agriculture in subjects like biology and science. The possibility of linking complex and abstract scientific concepts to a concrete practical understanding was as mentioned in chapter 4 important for many teachers. All these aspects mentioned implicitly and explicitly by the teachers, are also at the core of the learning goals for the subjects like science (nature/technology) and biology[xix] by the Ministry of Children and Education. In the Common Goals for science by the Ministry, the overall statement about the teaching is:

"The teaching must be largely based on students' own encounters, experiences, observations, surveys and experiments and contribute to them developing practical skills, creativity and ability to cooperate. The teaching shall maintain and promote students' pleasure in dealing with nature, technology, living conditions and livelihood conditions as well as their desire to ask questions and do research both inside and outside." (Undervisningsministeriet (Ministry of Education) 2009) (p. 3)

This in other words relates well with the learning goals and experiences offered through the food and agriculture teaching and especially with the opportunities in farm visits and outdoor experiments, which the cases and also many of the educational materials emphasize. Here the students learn about different factors and the interplay between nature, technology and living conditions in agriculture and are able to do their own observations and experiments. Observations and interviews with teachers showed that children are very interested and motivated in working with agriculture and food as real life issues in an open learning space, which a farm offers. The main obstacles for learning are the challenges of staying warm in cold weather and that some students with attention and behavioural problems also sometimes are hard to engage in activities on a farm or in a field.

The specific learning goals for Nature/Technology (science), which relate to agriculture and the learning goals and practices of the teachers include:

- ***To know about the different concepts of nature and describe examples of nature use and nature conservation as well as about conflicts of interest related to this****:* an example of this is the experiences and teaching about organic and conventional agriculture.
- ***To know the features of the history of technology and use as well as the effects on plants, animals and humans****:* this was highlighted both in many of the educational materials and by some of the teachers, who included visits to historical sites for the children to experience the development in agricultural production and technology.

- ***To know and describe the local area, i.e. by using maps and to be able to use the knowledge in other contexts:*** especially case study 3 was started with a strong motivation of focusing the science network's activities on one of the main source of income for their region, namely agriculture. Working with the agricultural sector was just one initiative to link science and education to a collaboration with and learning about local businesses. (Undervisningsministeriet (Ministry of Education) 2009) (p. 4)

Similar to the aims for the subject of Science, the overall aims for Biology offered from 7th grade is for it to be based on the students' own observations, experiments and encounters through e.g. field work (Undervisningsministeriet (Ministry of Education) 2009) (p. 3). Farm visits, school gardening and other experiments are examples of this. All the teachers and also farmers highlight the fact that various methods of hands-on activities - whether these are tours around the farm or more practical and experimental activities like growing their own potatoes or doing experiments with fertilization - increase and develop children's interest in science subjects and agriculture. This is also an important aim for the subject biology. Several of the educational materials both from DAFC, the organic producers' association, and the Gardens to Bellies school garden program have a strong focus on these experiential learning activities. Linked to the historical and cultural dimensions, mentioned by several teachers, the Ministry's overall aim of the biology is also that of enabling students to recognize science and technology and our understanding thereof as part of our culture and worldview. It aims to develop children's sense of responsibility for nature, environment and health and develop critical thinking and action in relation to this, which is closely in line with the learning goals in many of the learning materials, especially the ones from the organic producers' association, Coop Denmark and the Ecological Council. Since many teachers in the case studies taught 6th grade and below, this is not so prevalent in the learning goals of the teachers. The teachers teaching 7th grade and up and/or using the materials from the organic producers' association on the other hand had an emphasis on developing their students' sense of responsibility and connectedness to nature, environment and their own health (case study 2 and 4).

The specific learning goals of biology, as formulated by the Ministry, in relation to the agriculture include:

- ***To explain how various industries, including agriculture, are dependent on natural resources:*** this was done by all teachers and farmers during farm visits and after, especially in working with organic agriculture. It was also important in the teaching materials by the producers' association on organic agriculture. However, there was very little attention to this in the materials by DAFC, except the booklets focusing on plant production. Most of their materials are about animal production, where natural resources are not mentioned, except the lifecycle of an animal.
- ***To explain food in relation to biological processes and principles*:** teachers worked with explaining e.g. photosynthesis, ecology and natural cycles through visits and experiments on-farm and later in the classroom. Again these principles are included in the teaching

materials by the organic producers' association and Gardens for Bellies and also some of the teachers' own materials, e.g. in case study 2 and 3.

- ***To explain important biological processes related to food processing, including fermentation, production of dairy products and preservation****:* This is illustrated through visits to dairy farms, experiments with pH values, soil analysis and hands on potato-growing, where biological processes like how the cleavage of starch in the body through enzymes can be converted into glucose. Several of the DAFC materials on for instance milk and cheese, include such explanations and hands-on experiments for the students.
- ***To explain humans' view and use of production animals, pets and animals in captivity****:* This is a key learning goal in many of the materials by the DAFC. The teacher SC in case study 1 working with animal husbandry and the dairy and meat farmers interviewed put emphasis on this, i.e. explaining the nature of cows, how they are raised in captivity and the production process on-farm. (Undervisningsministeriet (Ministry of Education) 2009) (p. 5)

In the subject Home Economics, which is generally taught from 4th grade through to 7th also has a strong emphasis on experiential learning, critical thinking and citizenship as well as the connections between the individual's lifestyle and food preferences and the society and natural resource base. Although it is not an important subject in terms of hours and resources allocated to this subject, the Ministry has included many ambitious learning goals related to food literacy, social skills, life skills, citizenship and action competence mentioned earlier.

In terms of life skills, the aim is to develop the students' self-esteem, imagination, joy of life and reflective capacity, so they each become motivated and capable of forming opinions based on critical thinking and taking actions privately and together with others in the surrounding society. (Ministry of Children and Education, 2009, p. 3 (3))

There is an emphasis in home economics on ESD and the development of citizenship and action competence of the students:

"The teaching must prepare students to participate in and take responsibility for problems related to food, household and consumption in terms of culture, health and quality of life and sustainability. The teaching must encourage that students experience the value of a community and cooperation based on equality and democracy." (Undervisningsministeriet (Ministry of Education) 2009) (p. 3)

Several of the more specific learning goals found in the educational materials and expressed by teachers and others in the interviews, are expressed directly in the learning goals for home economics by the Ministry, including:

1. ***to gain an understanding of farm-to-table issues (origin, season, production, distribution, purchase, use and disposal)***
2. ***to analyse different food groups and their quality in relation to taste and technical characteristics, health, environment, ethics and price***

3. ***to know their rights and duties in relation to the purchase and use of goods***
4. ***to analyse factors that control our consumption, diets and housekeeping, including the development of product range, technology and marketing, time, effort and resources in everyday life and cultural aspects and aesthetics***
5. ***to explain the impact of food, consumption and hygiene on the environment, health and quality of life***
6. ***to apply principles of sustainable household in connection with shopping, cooking, dishwashing, cleaning, washing and waste-handling***
7. ***to critically evaluate the conditions for sustainable living as a consumer including health and quality of life.*** (Undervisningsministeriet (Ministry of Education) 2009) (p. 3)

As with the teaching methods in the previous subjects, the Ministry also emphasizes teaching that enable the students to experiment, work with hands-on activities and experiences using all their senses. There is a focus on students developing their imagination and creativity and for them to be able to express themselves innovatively and aesthetically. (Undervisningsministeriet (Ministry of Education) 2009) (p. 4) Again these learning goals and teaching methods are directly in line with the practice and learning goals found in the four case studies and in the educational materials available. Primarily the first and second one above are addressed in the cases (which only in case study 4 included home economics), whereas the rest of these learning goals to varying degree are addressed in the various educational materials. However, in the educational materials reviewed, environmental impacts related to food consumption and production is only addressed to a limited degree.

Home economics is the subject, which according to the Ministry's Common Goals, has the strongest emphasis on food literacy, food citizenship, sustainability and ESD. It includes linkages between the students' own lifestyle and daily practices, personal responsibility, development and experience in taking action and making connections between their own lives and the impact on and conditions of the environment, natural resources and wider society. Having said that, home economics is a relatively under prioritized subject, with a low status and few teaching hours, for which reason there is little time and resources to ensure that the ambitious goals are met. The school in case study 4 is the only school of the four cases, where agriculture and food education is connected to home economics and where the cooking activities in the school canteen is linked to the farm visit and teaching in both home economics and science. In the rest of the cases, food literacy goals are integrated into the science.

A few other subjects also touch on some of the identified learning goals. Social science taught in 8th and 9th grades is a subject that emphasizes citizenship and preparing students to become active members of a democratic society. Learning goals in social science are therefore based on developing students' competences in critical thinking, participation in democracy and understanding society's democratic principles and values as well as gaining an understanding of themselves and their own values. (Undervisningsministeriet (Ministry of Education) 2009) (p. 3) It is in other words a subject that has a strong value-based emphasis, which has also been emphasized

in some of the other subjects and educational materials, such as the Critical Consumer materials from DAFC (Dansk Slagtefjerkræ 2007).

In addition to the focus on fostering a democratic understanding and competence, the subject has emphasis on sustainable development; that the students understand the concept of sustainable development based on economic growth and environmental protection issues and challenges and are able to understand the perspectives, interests, ideologies and behaviour of different groups and stakeholders in society. (Undervisningsministeriet (Ministry of Education) 2009) (p. 4-5) This relates well to the World Commission on Environment and Development's and others' three-dimensional approach to sustainable development (World Commission on Environment and Development 1987, United Nations Conference on Environment and Development 1992). It falls well into the broader learning goals of some of the teaching materials especially DAFC's booklet on the Critical Consumer, which also target social science. The practice of some of the teachers in case study 1 and 2 reflect the focus on critical thinking and democratic competence. However, none of the cases worked with social science in their food and agriculture teaching. The same is the case for the subject geography, where there is also emphasis on understanding society's use of nature and natural resources and for students to develop:

"Responsibility towards nature and use of natural resources and technology […] so that they have confidence in their own ability attitudes and action in relation to issues about human's interaction with nature - locally and globally" (Undervisningsministeriet (Ministry of Education) 2009) (p. 3).

None of the cases had food and agricultural teaching and collaboration with farmers included in the subject geography and social science. Yet in these subjects (as well as mathematics and Danish which according to farmers, some teachers also integrate a farm visit), there is a clear overlap in learning goals with those of the science teachers and educational materials. In other words, farm visits can easily be integrated into these other subjects.

Although only few of the science teachers in the case studies worked with sustainability and sustainable development, science from 2^{nd} – 6^{th} grade according to the Ministry of Children and Education include the following overall aim related to sustainability:

To understand the concept of sustainability and be able to explain that examples of human's consumption of resources and use of technology affect the cycles in nature and assess the implications this has for plants, animals and humans (Undervisningsministeriet (Ministry of Education) 2009) (p. 4).

It is elaborated in the learning goals after 6^{th} grade to include:

To use the concept of sustainability and provide examples of sustainable development:
- to give examples of how changes in the use of technology have affected the plants, animals and humans

- to know environmental problems locally and globally as well as provide examples of how these problems can be solved, including proposals for energy saving tips in RELATION to use of water and electricity and in relation to the use of renewable energy. (Undervisningsministeriet (Ministry of Education) 2009) (p. 8)

Learning about various resources, resource use and how humans impact nature from a daily life perspective, which the students can relate to, is part of the learning goals, even in the 2nd grade. Aspects of and direct reference to sustainability and sustainable development is in other words a key part of the learning goals and overall aim of science from 2nd-6th grade. In practice, as the case studies highlight, most of the teachers are not working actively with sustainability and sustainable development perspectives in this subject, apart from a few exceptions, in spite of the fact that it is clearly part of the goals set forth by the Ministry.

5.3. Underlying values and perspectives for food literacy, food citizenship and ESD

In this section, I will identify the values underlying the learning goals. Based on the categories of learning goals in the previous sections, I have identified values in three overall areas:

- Sets of values related to food, agriculture and nature (related to the learning goals of food literacy, agriculture and ecology, including sustainability)
- Values related to teaching (connected to the methods of teaching and how to learn)
- Values related to bildung/life skills (connected to life skills, social skills and action competence learning goals)

As mentioned, values are about perceived differences and presuppose a ranking order between what is perceived as better or more correct than something else. It involves reflecting over one's own values and the values prevalent in society (Luhmann 1995, Wistoft 2009). Values are closely linked to learning goals, as they influence the learning goals and teaching approaches (Wistoft 2009). Learning goals are influenced by the teacher' values but also by external factors primarily the goals and requirements by Ministry of Children and Education, which again are based on values in society related to teaching, nature, science etc. In addition to this, teachers' values and learning goals although interrelated are also linked to the knowledge and prerequisites of the teachers. Thus, teacher's values, knowledge and other prerequisites impact what the students are taught and the methods used.

Individual values cannot be directly observed. The main way of investigating values will be to look at personal values of the teachers and farmers through an interpretation and analysis of what is communicated and written in the learning goals as a whole from e.g. educational materials.

5.3.1. Underlying values and norms behind the programs

Based on the overall themes analysed under learning goals, the following areas of values will be analysed; values related to food, agriculture and nature as well as teaching (including here values related to teaching methods) and underlying bildung/life skills. These are all values related to the key concept of food literacy, food citizenship, action competence and sustainability and ESD.

Values related to food, agriculture and nature

The goals of understanding agriculture, where the food is coming from/farm-to-table process and a connectedness to nature are linked to either overlapping and separate values. One line of values is about connectedness: *connectedness* with nature, land, agriculture and food. Another value is about *transparency*: transparency between the producers and consumer or transparency in the broader food system. These values can be linked or there is focus on one of them. For instance, there was a tendency in some case studies, especially amongst the conventional farmers and in some of the educational materials to have a strong emphasis on the transparency in the production. On the other hand, there were farmers (especially the organic farmers) and some teachers who focused on connectedness: moving away from a food system and lifestyle where agriculture, nature and food are disconnected, distant from (mentally and geographically), unimportant to and hidden from the consciousness of consumers or citizens. Implicitly there is a difference between seeing agriculture and nature based only on its instrumental value - when food, income, export and culture were mentioned - or also for its inherent value, when understanding the connected parts in nature were in focus. What all stakeholders had in common, however, was the value of *connections*: strengthening the connections in the food system, especially amongst consumers and producers.

Alice Waters, the renowned chef and founder the Edible Schoolyard at the Martin Luther King Middle School, Berkeley, C.A., US wrote about fast food values and slow food values. Her observations about the values surrounding food are somewhat similar to some of the concerns and values of teachers and farmers and organizations working with food in Denmark. According to Waters, some of what characterizes fast food values is a perception that food is "cheap, abundant and resources finite", which makes it acceptable to waste food. Understanding seasonality and where food comes from is not important from this value base. In addition, meat, soda and other fast foods are viewed as healthy and taste as less important. Instead of the fast food values, which dominate the perception in America and other Western societies of nature, agriculture and food, slow food values are instead about understanding and appreciating the connectedness between our food and nature and farming, and the *real cost of food.* It is about valuing and promoting cooking and the common meal and encouraging human interactions, knowledge about the origins and taste of food when eating out, and recycling and composting should be promoted, according to Waters. (Waters 2005) The value of cooking and being able to connect and use what the children have grown themselves or experienced at the farm to their daily practice through cooking, was also a value integrated in most of the Danish cases.

Values related to nature influence and are connected to people's values related to food. The Common Goals by the Ministry as well as the focus of several teachers and interest organizations

reflect a shift in these values: a shift from seeing nature, agriculture and food and people as being disconnected, to one of seeing and valuing a connectedness between food and nature and a concern about how, where and when food was produced. Especially the organic producers and teachers taking their students to organic farms had values about this connectedness and of linking an understanding of organic farming to an understanding of nature. The former disconnection between our food, agriculture and nature is found in the general disregard by many consumers for seasonality of food, lack of focus on and interest in production and understanding nature. The shift in the opposite direction is a reflection of the opposing green values in society. These values are about *seasonality, organic and local foods* and *nature and agriculture interest*. Again the organic farmers and some of the teachers taking their students to organic farms had such values.

In a sense these values break with the dominant human-centred worldview in society, where humans are regarded as being separate from and above nature and animals and disconnected from food production. They are in opposition to the fast-food values, which Alice Waters talks about. It follows a green trend in society, where food receives significant attention in the Danish media and amongst concerned citizens and teachers. According to DAFC staff, many teachers follow this trend too of being concerned about nature and organic food. Annette in case study 2 and Simone in case study 4 are good example of this, wanting their students to learn about organic agriculture and food, seasonality of food and growing their own food. Annette quite literally seems to have experienced a shift herself: from using the school garden at the organic community to primarily bring together her students socially, to discovering the benefits of the connectedness to food and nature at the farm. These shifts in values are to some degree reflecting the move towards a more eco-centred worldview in which humans are regarded as connected to nature. Primarily the organic farmers and teachers in case study 2 and 4 highlighted the importance of the students experiencing the connections between nature on the farm and themselves and of valuing all life forms. This was seen in the way they focused on teaching respect of insects and animals and harming insects and worm would be harmful to the rest of the food chain. Showing students the interactions between different systems on the farm is another example: understanding how crop rotation, natural fences and ponds are important for organic agriculture, a healthy environment and food, and why in effect organic food is more expensive. To sum up, the values, which all this relates to, are about *connectedness* and *ethical responsibility* for protecting nature through our food choices.

These values are, however, not reflected in all the stakeholders and educational materials. Although the understanding of the farm-to-table process is found as a common learning goal amongst most stakeholders and teaching materials, there are different values behind this learning goal. For some, as stated above, it is that nature, agriculture and food are interconnected. This is especially reflected in the values of the organic farmers and the producers' association, the Ecological Council, organic farmers and several teachers and also in the objectives and goals by the Ministry in the subjects analysed earlier. However, when looking at the values of the conventional farmers and the DAFC and even some teachers, there is a different emphasis. Here the understanding of agriculture is important due to values of *history, culture* and *economy*. Establishing a relationship and understanding between producers and consumers are also one of the core values. For DAFC, their

farmers and some of the teachers, the main value was about *transparency* and *understanding* of the agricultural production, farmers and the historical, cultural and economic importance of agriculture in Denmark. There is a shift: from a disconnection between consumers and farmers towards valuing *closer producer-consumer ties* and understanding. Longer and longer food chains and less direct contact between producers and consumers are an example of this disconnection, which for decades have become more and more distanced with fewer and fewer people being connected to agriculture or buying directly from farmers. The values emerging from the farm-school collaboration and related teaching are an emphasis more on *human connections*, *transparency* and *trust* as important values within the food system rather than *connectedness* to nature and *sustainability* linked to the former values. There is a tendency amongst some of the teachers, e.g. Laurits, Bente and Simone in cases 2, 3 and 4, to view large-scale and monoculture production (organic or conventional) as '*modern*' and alternative production models, such as the organic and sustainable living community and the socio-economic enterprise farm, as *'old-fashioned'* or '*idealistic'*. This reflects their values related what is the 'right' kind of production.

There are in other words two different sets of values at play in farm-school collaboration. One set of values primarily has a transparency and producer-consumer focus, and does not necessarily emphasize nature and environmental values (e.g. largely amongst teachers and farmers focusing on conventional production). The other one focuses on organic agriculture and values connectedness to nature and environmentally and ethically responsible consumption.

The value of animal welfare through an understanding of animal behaviour is present amongst both the farmers interviewed and DAFC and OD. It is connected to a view of what is feasible given the production conditions. Several farmers emphasize the value of treating their animals well, i.e. *animal welfare*, as a reaction to the many stories in the media about poor animal welfare, which is especially a concern for conventional farmers. Given that Danish farmers are largely livestock farmers and the fact that meat consumption has key importance in the Danish economy and food habits, there are many values attached to this and focus on meat, livestock production and animal welfare in the teaching related to food and agriculture. Not surprisingly, the only criticism found in the educational materials about the livestock production and meat consumption was from the Ecological Council.

The focus of some teachers and educational material also reflect a value of learners being more than future consumers, but also future citizens in some cases. Although there is emphasis rhetorically on 'the critical consumer' or 'the conscious consumer', the learning goals of some but not all teachers and educational materials reflect a focus on *citizenship* and democratic learning; giving students' experiences, perspectives on and concern for decisions and actions. The importance of educating young people to become *responsible* and *critical thinkers* capable of making conscious choices that go beyond their own individual needs is a key value here. The organic producers' association's educational materials have this as an underlying value and the same does DAFC's (specifically The Critical Consumer) as well as teachers like Laurits, Simone, Stine and Bente (in case studies 2, 3, and 4). This is seen as the 'correct' type of future citizens to strive for, and is in opposition to seeing

individuals as merely consumers; uninformed, uninvolved and indifferent to society and to their food. As mentioned earlier, values are viewed in opposition to something else and less desirable, which is illustrated in table 11.

Table 11: Values related to the individual

Values related to the individual	
Citizen and consumer:	*Consumer:*
Conscious consumer	Uninformed/unaware
Critical consumer	Uninvolved
Responsible/concerned citizen	Unconcerned
Involved citizen	

Most of these values representative of the teachers, farmers and the educational materials by the interest organizations are in many ways in opposition to more mainstream values in society dominated by mass-production, global food chains, fast food and lack of conscious consumption. For that reason, farmers and teachers highlighted a concern about losing the understanding of and appreciation for agriculture and nature and knowledge about food, health and cooking skills. DAFC is seeing this change in values through an increasing interest by teachers in food and their educational resources during educational fairs. However, they stressed that it is difficult to relate this perceived increase in interest directly to an increase in the number of farm visits (e.g. due to lack of reporting prior to 2010).

The case studies reveal that the values of teachers related to organic agriculture and conventional agriculture are quite varied. For several teachers and in the teaching on food and agriculture, the importance of objectivity and encouraging the students to make up their own minds about organic and conventional agriculture outweighs personal values of the teachers (e.g. in case studies 2 and 3). In case study 4, the school policy to purchase organic foods in the canteen and the teacher's implicit preference for organic agriculture are values, which tend to influence the learning goals and content of the teaching with an emphasis on organic agriculture.

What characterizes the teachers and those represented in the educational materials by DAFC is that there is no questioning of the sustainability of the current food system. The main focus is on transparency and the origins of food and connecting the students with farmers, agriculture and nature. Yet a broader questioning and reflections on future agriculture to ensure sustainable development in the food system through personal action are not issues or values presented by the stakeholders explicitly. It is, however, a key value present in the learning materials and work of the Ecological Council and the producers' association for Organic Schoolyards.

Table 12 sums up the different values at play, where there seems to be two different sets of values at play: connectedness and transparency. Under each of these two, there are a number of related

values, all of which are connected to an overall worldview. Connectedness being related to an eco-centred worldview and transparency (and related values) linked to a human-centred worldview, which also has a strong production, economy and history focus.

Table 12: Connection between values related to food, agriculture, nature and worldviews

Values related to food, agriculture and nature	**Worldviews**
Connectedness - Nature - Seasonality - Organic and local food - Animal welfare - Responsibility - Sustainability	← Eco-centred worldview
Transparency - Producer-consumer ties/human connections - Production - Trust - History - Culture - Economy	← Human-centred worldview

The values and worldviews are replicated in the learning goals and content of the educational materials. The table illustrates well what can in a sense be seen as two different narratives related to Danish food and agriculture: one being human-centred and the other being an eco-centred narrative and worldview.

Values related to education and teaching

Nearly all stakeholders express a strong value related to educational ideals of *experiential learning*. Most interviewees including farmers highlight learning by doing something practical, learning by using all the senses and outdoor learning as implicit values. The main rationale is that theory can be taught better through practice, i.e. experience. These values are also present in several of the Ministry's Common Goals documents, which encourage teaching to take place based on students' own encounters, experiences, observations and experiments. The value of learning through practice and the importance of *practical skills* and *creativity* are also highlighted by the Ministry as important values, e.g. in subjects like science, biology and home economics. There is in other words

a different educational ideal or value at play here than the mainstream academic classroom teaching approach, which most teachers across the country is used to. The importance of moving teaching outside and making it relevant to students in order to promote motivation and pleasure in learning is an important underlying value for many of the teachers interviewed. The same can be said for some of the farmers, who see their own role and the outdoor learning environment at the farm as an important part of transforming education. The main set of values here is in other words experiential learning and combining theory and practice. It is, however, important to stress again that the teachers interviewed in the four cases are teachers with motivation and interest in teaching outside the classroom. Many other teachers do not have the same interest and experience. The values related to teaching and education are summed up in table 13.

Table 13: Values related to teaching and education

Values related to teaching and education
Experiential learning - Practice-theory - Real-life encounters - Outdoor learning
Creativity
Practical skills
Transformational

None of the teachers interviewed expressed values related to putting their teaching within a perspective of sustainable development (ESD): participatory, future-oriented, problem-based and vision-oriented and relating their teaching to empathy for current and future generations. I will come back to that at the end of this section.

Values related to life skills and social skills

Life skills and social skills were also important learning goals to several teachers. Although there is much emphasis on developing children's cognitive and skills-based competencies through experiential learning, the importance of the school in developing students' life skills and social skills is a key value for a few of the teachers. For Annette and Bente in case studies 2 and 3 and some farmers, this was about *kindness* (treating others kindly) and *collaboration* (i.e. learning how to collaborate) and having a *sense of community*. These values are both related to social skills and life skills. Others valued students' *critical thinking* and encouraging them to form their own opinions more, including questioning things and what they are told, which is linked to broader life skills. This was an important value for Laurits in case study 2 and Simone in case study 4. Also the Ministry and the interest organizations, e.g. the producers' association and Coop Denmark (and DAFC in their booklet the Critical Consumer) valued critical thinking in their learning goals.

For others the development of *democratic competence or values* was an important underlying value linked to life skills. This was revealed in the educational ideals of *action competence* and active participation in society, which were important values for a few teachers, such as Laurits and Simone from case 2 and 4, and for Coop Denmark and the Ecological Council in their materials. These teachers highlighted the importance of the children learning democratic values of understanding the views of others, e.g. by investigating issues from the farmer's perspective or from both an organic - and conventional farmer's perspective. However, there was only limited focus on participatory and action oriented learning goals based on democratic values. It was mostly tied to the forming of own opinions. Working with conflicting interest and dilemmas also reflect underlying democratic values in the Ministry's learning goals, the ESD materials and the practice of some teachers. Laurits' students and the students at the private rural school in case study 1 worked with these conflicting interests more actively. However, other teachers did not include this as an important value in their teaching.

The two main sets of values here were in other words about kindness, collaboration, communication/personal agency and community on the one hand, which are both linked to social skills and broader life skills. Values related to life skills specifically were about democracy, critical thinking and action competence. This is summed up in table 14.

Table 14: Values related to life skills and social skills

Values related to life skills	**Values related to social skills**
Kindness/empathy	Kindness/empathy/manners
Collaboration	Collaboration
Personal agency	Communication
Community	Community
Democracy	
Critical thinking	
Action competence	

Perspectives for food literacy, food citizenship and Education for Sustainable Development

From the perspective of looking at values as influencing learning goals, food literacy and (food) citizenship can in fact be viewed as the overall values or ideals related to the teaching. As shown in the data analysis, there is a difference between food literacy and food citizenship as an overall learning goal or value. The focus of most teachers and interest organizations is on food literacy as an important value. This tends to be the case for especially DAFC, Gardens for Bellies and teachers in case study 1 and 3. For these teachers, DAFC and Gardens to Bellies, however, this is also linked to respectively agricultural literacy and/or ecological literacy, although understanding food as a cross-cutting value and learning goal.

Only a few teachers had broader considerations of working with food to develop broader life skills or promoting citizenship through food (e.g. mentioned by Simone in case study 4). The food citizenship focus was also a value present in the teaching materials from the Ecological Council and Coop Denmark, the Ministry of Children and Education and to some extent in the materials from the producers' association/Organics in Schools targeting higher grades. Sustainability and ESD perspectives and values were present in their educational materials and were well integrated into the Common Goals by the Ministry of Children and Education as mentioned in 5.2. Some teachers, including Annette, Laurits and Bente in case studies 2 and 3, included such perspectives in their teaching. However, for the majority of teachers values of citizenship, sustainability and ESD principles did not seem to be prevalent. In fact, as mentioned there was limited or no focus on Education for Sustainable Development as a value: or to be more specific values related to student participation, future orientation, visions and empathy for current and future generations.

To conclude this section, the core values and related learning goals from the empirical analysis are summed up in the figures on the following pages. The categories used in 5.2. and relevant to the theoretical point of departure have been replaced with new categories and terms. Some of this will be presented in chapter 6. These changes are noted in the following tables:

1. Farm and agricultural knowledge – replaced by 'Agricultural literacy' (to be presented in chapter 6)
2. Food knowledge – Food literacy – Now just 'Food literacy'
3. Ecological, nature and environmental knowledge – replaced by 'Ecological literacy' (to be presented in chapter 6)
4. Specific academic skills - have not been included directly in the figures and the following chapters as it is not related directly to the further theory development. However, it is to some extent integrated into e.g. agricultural literacy, food literacy and ecological literacy in subjects like science, biology, home economics and social science.
5. Social skills - have not been included directly in the figures and the following chapters as it is not related to the further theory development. However, it will be followed up in chapter 7 (7.2).
6. Life skills – have not been included directly as it is also not related to the further theory development. However, it will be followed up in chapter 7 (7.2).
7. Sustainability understanding – has been replaced with 'Sustainability Understanding and ESD'
8. Action competence – has been updated to 'Food citizenship and action competence'.

The following learning goals mentioned in this chapter 5 are summed up here:

1. **Food literacy:**

a. To understand the food system and the farm-to-table process, including; ➢ locality of food and the food system, i.e. that some of our food is produced locally and much of it is imported, ➢ relating this to our daily lives.
b. To understand food uses, food diversity and agricultural biodiversity
c. To understand food quality, health and nutritional aspects, including what constitutes a balanced diet
1. To have skills related to the food process, including experiences in: ➢growing, harvesting, processing, preparing/cooking and/or other processes
d. To have courage to try new foods
e. To have manners when eating
f. To have skills and interest in sensing, handling and using different foods, including: ➢skills in food hygiene ➢a sensory understanding of food ➢language related to food and tastes ➢seasonality and climate friendly foods
g. To apply principles of sustainable household in connection with shopping, cooking, dishwashing, cleaning, washing and waste-handling
h. To develop awareness, reflection and critical skills, e.g.: ➢different production methods, animal welfare conditions, environmental impacts, labelling, nutritional and hygiene understanding ➢your own role and impact as a consumer
i. To gain insight into conditions and connections between health, diets, environment and ethics e.g.: ➢ impact on working conditions, animal welfare, climate and other environmental impacts through your food choices. ➢ experience with sustainable consumption solutions and actions.
j. To understand the global food economy, food system and societal impacts on food and diets including being able to: ➢Give examples of how everyday life is influenced by globalization ➢Account for values and norms and argue for your own opinions ➢Discuss and reflect on issues related to food security, animal welfare and environment – locally, nationally and globally

2. Agricultural literacy:

a. To understand the farm-to-table process, including the different steps along the food chain
b. To understand basic concepts in agricultural science and choices farmers make as well as the importance of agriculture in society, economy and history
c. To understand different production methods and conditions including information about conventional, free-range and organic production, conditions.
d. To understand basic concepts related to plant physiology, morphology and ecology as well as animal behaviour, anatomy and life-cycle.
e. To understand livestock and plant biodiversity and uses
f. To understand the soil, including soil composition, fertilization and other factors

g.	To gain insight into the agricultural profession and life on the farm
h.	To develop hands-on skills and interest in growing your own food
i.	To gain insight into the food and agricultural sector, including its economic importance, the stakeholders and stakeholder interests
j.	To gain insight into historical factors – including societal and technological development - and its influences on Danish food and agricultural sector

3. Ecological literacy:

a.	To understand key ecological principles; including light, photosynthesis, nutrient cycles, food chains, soil, groundwater, seepage of pesticides and nitrogen oxides and related issues.
b.	To understand interactions between farmers, the natural cycle and resources in the production, including a respect for nature (insects, worms and livestock)
c.	To understand key concepts within agriculture, ecology and sustainability
d.	To gain an insight into plants and the different types of plants we eat
e.	To be able to relate these broader concepts to daily life and the types of plants we eat.
f.	To gain an insight into and interest in food, plants, nature and science using all the senses
g.	To feel a connectedness to and curiosity about nature
h.	To have an interest and skills in growing and cooking your own food

4. Food citizenship and action competence

a.	To develop one's own opinion and values based e.g. on knowledge, experiences, involvement and/or co-determination.
b.	To get experience in communicating views and participating in democracy e.g. concerning organic food and animal welfare through social media and other platforms.
c.	To be able to place the daily actions of others and oneself in a societal perspective.
d.	To develop a personal value base to form opinions and an interest in influencing societal conditions.

5. Sustainability understanding and ESD:

a.	To understand how food production and consumption affect nature, environment and humans
b.	To understand the concept of sustainability and be able to provide examples of sustainable development related to food
c.	To know about environmental problems locally and globally as well as being able to provide examples of how these problems can be solved
d.	To be able to relate sustainable development to actions in your daily life.
e.	To be able to critically analyse and form opinions about sustainable foods systems and behaviour, including a more sustainable and humane production, consumption and waste handling.

5.4. Discussion

As seen is this chapter there is a strong focus on food literacy as an overall value and learning goal

behind most of the teaching in the four case studies and as an underlying goal behind many stakeholders' educational programs. Many of the learning goals from interviews and educational materials focus on cognitive learning goals, albeit also with a number of more skills-based and affective learning goals, which the hands-on activities, real life encounters and experiences on the farm are especially conducive for. Learning goals and values related to food citizenship and Education for Sustainable Development - including action competence - are on the other hand somewhat neglected, but with some exceptions. Food consumption and agriculture are crucial areas of action to bring about sustainable change. However, few teachers explicitly included sustainability, actions and change as perspectives in their teaching on food and agriculture. Yet if the teachers follow up on these perspectives later on the education, the practical understanding of agriculture and food production and interest and experience in science can be further developed within a sustainability - and action-oriented perspective. In fact the programs included many important building blocks, which, if used, could enhance students' understanding of and interest in food, agriculture and sustainable development later on in the education. There was a dominant perception that ESD principles and sustainability was relevant only for older students. However, development projects related to ESD and experiences from the 3rd grade teacher in case study 2 proved that it can already be introduced in 3rd grade, which is also highlighted in the goals for science by the Ministry of Children and Education.

In modern societies where there is a risk that values are passed on blindly to consumers through the media and commercials, the importance of working explicitly with reflections on and development of values and opinions in primary school is crucial. This is also reflected in the learning goals by the Ministry of Children and Education and some of the educational materials, like materials "The Critical Consumer" (DAFC) and "The Products Leave a Trail/Footprint" (Coop Denmark), which have explicit learning goals of working with values and opinions.

Although the teachers in the four cases are just a fraction of the teachers working with food and agriculture issues, they were largely committed and engaged teachers, who attached great importance to teaching their students about food. Some worked with dilemmas about buying either organically or conventionally produced foods. However, for most, challenges to sustainable development (including climate- and other food production and consumption related environmental impacts as well as global and local perspectives) were not included as perspectives. It was also not a perspective present in most of the educational materials, apart from those by organic producers' association/Organics in Schools, Ecological Council and Coop Denmark. It is therefore likely that many teachers across Denmark also do not include these broader sustainability challenges and solutions in their teaching if their knowledge, tools and interest in working with action competence and ESD perspectives related to food and agriculture are limited. Teachers' interests, values, background and prerequisites have an impact on what students are taught and how; in other words affecting the learning goals and methods and in the end the actual learning. As mentioned in Chapter 3, teachers' background and familiarity with agriculture was also highlighted as an important factor for integrating it into the teaching in the US (Trexler, Hikawa 2001, Knobloch, Ball et al. 2007).

A challenge with the existing educational programs and materials is that many of the available materials are from commercial interests i.e. agricultural interest organizations, which only represent one viewpoint and have a vested interest. Only few materials are available from environmental organizations and recently (but not part of this review) also municipalities. There are, however, some benefits of the materials from agricultural interest organizations; they are experts in their field and have produced free and thorough materials. These resources combined with one or more visits to a farm are an excellent way of fostering students' food and agricultural literacy as well as more general academic skills and life skills. However, there is a risk that students get a biased impression and view of agriculture, if they are not presented to other types of farms and views and work with booklets and other materials that add other perspectives than the dominant agriculture and food perspective prevalent in learning materials from DAFC and the organic producers' association. Both the organic producers' association and DAFC's teaching materials are biased towards their own organization's interests, unless teachers provide their students with a critical view and facilitate future visioning related to the current conditions and reality. There is a need for skilled, engaged and motivated teachers with the ability to synthesise the information with the students and facilitate his/her students' reflections, critical thinking, innovation and visions for the future, which the Ministry is also advocating for in their current educational standards and goals.

Chapter 6 Food literacy, food citizenship and ESD – a conceptual view and its link to farm-school programs

This chapter will give a more thorough review of research and conceptual papers written in the area of food literacy, agricultural literacy and food citizenship than in the theoretical framework in chapter 2. The aim is to discuss, frame and further develop the theoretical foundation of the Ph.D. project. More specifically, the aim is to contribute to existing conceptual and theoretical perspectives by linking food and agriculture literacy together and within a broader perspective of educational goals related to food citizenship and Education for Sustainable Development. Finally, I will link these theoretical perspectives to farm-school programs and argue how these can help contribute to theory and practice in food and agriculture education.

6.1. Current theoretical perspectives on food literacy, agricultural literacy and food citizenship

The concept of 'literacy' is increasingly used in a much wider sense than in its original meaning related to the ability to read and write. It is taking on numerous forms and fields of knowledge: each of which is an integration of different values and ways of thinking, acting and interacting. This ranges from *individual literacies* (in various fields e.g. reading, science, nutrition, health) - often either implicitly or explicitly equalling individuals to consumers - to what Cardwell (2005) defines as '*citizen levels of literacy'* (Cardwell 2005), the latter, which I will come back to in section 6.2.2.

6.1.1. Food literacy and agricultural literacy

Although the need for agricultural literacy is not as essential as reading, writing, science and math literacy for our society to work, there have been increasing demands from consumer- and environmental organizations and other NGOs for a functional level of agricultural literacy especially in the US (Powell, Agnew et al. 2008) to understand food safety concerns and environmental trade-offs associated with the agri-food system. Findings from the case studies in chapter 5 also emphasize that understanding agriculture and ecology are key underlying objectives in the educational programs and also the overall learning goals behind farm visits and related teaching back in the classroom setting. This links well to recent studies on agricultural literacy, which have been done in the US on agricultural literacy programs attempting to support a more systematic instruction about agriculture for all kindergarten to grade 12 students. These programs and related research highlight the view that agriculture and food is too important a topic to only be taught to a relatively small percentage of students considering careers in agriculture. The rationale behind these programs and research are directly linked to the fact that the majority of Americans are now two to four generations removed from the farm and have no direct link to farming. (Powell, Agnew 2011) This concern is also at the heart of farmers' and agricultural interest organizations' involvement in educational activities in Denmark. My case studies reveal that farmers and their interest organizations are very motivated to be involved in educational activities to re-establish an

understanding of agriculture and promote transparency in the agricultural production. An understanding of production details and conditions is seen as a way of avoiding misconceptions originating from media scandals. A strong focus is in other words on transparency and understanding and defending the agricultural production in the Danish programs promoted by farmers and agricultural interest organizations. There is a different focus in the agricultural literacy program Food Land and People analysed by Powell and Agnew (2011) where the lack of public awareness of the moral and ecological ramifications of agriculture and the food systems are underlying objectives. One of differences between the rationales of the Danish and American programs is likely to be found in the fact that the programs in Denmark are funded and developed by the agricultural interest organisations, whereas the project mentioned above from the US is run by a non-profit organization. [xx]

Turning to food literacy, the work of Fordyce-Voorham (2011) focuses on the identification of essential food skills. It is based on qualitative interviews with 50 food experts in Australia, including home economists, chefs, nutritionists and dieticians and young people (12-18 years), and very much exemplifies the focus on individual level consumer skills as being the main scope for food literacy here. The focus of this study is on food literacy being linked to practical knowledge, information and skills related to giving young people the ability to make nutritionally and economically sound decisions and practices regarding food shopping, meal planning, cooking, hygiene and safety, use of equipment etc. It includes the individual's ability to read, understand, and act upon labels on fresh, frozen, canned, processed, and takeout food, but also to consider ethical farming and manufacturing practices and seasonality in their decision-making. The emphasis is in other words very much on consumer skills related to food. The role of parents, peers and access to community resources in fostering and promoting food literacy was highlighted in the study. (Fordyce-Voorham 2011)

A similar study of Australian food experts [xxi] and their understanding of food literacy by Vidgen and Gallegos (2011) is based on the Delphi method. The first round of semi-structured interviews revealed limited understanding and use of the term food literacy, although most had heard of the term. (Vidgen, Gallegos 2011) The same tends to be the case in the Danish context, although the term is more widely used related to projects and education, albeit still with limited common understanding of what the term actually entails and how to define it. However, efforts have been made by Carlsson and Benn (2010) and Carlsen (2011) and a conference held in 2012 to discuss the theories and practices behind food literacy in Denmark. (Carlsson, Benn 2010, Carlsen 2011) The first round of interviews in the Vidgen and Gallegos study was followed by two online surveys with the same participants. An outcome of this process was the identification of a definition and 7 core components. Similar to the Fordyce-Voorham study (2011), this study and its definition of food literacy also takes on a strong individual focus:

"The relative ability to basically understand the nature of food and how it is important to you, and how able you are to gain information about food, process it, analyse it and act upon it"(Vidgen, Gallegos 2011) (p. 33).

It includes the following seven components, which also implicitly point to a strong individual and consumer-oriented focus:

1. Being able to access food through some source on a regular basis with very limited resources.
2. Being able to choose foods that are within your skill set and available time.
3. Knowledge of some basic food commodities and how to prepare them,
4. Knowing how to prepare some foods from all the food groups, e.g. how to prepare meat, how to cook pasta, prepare vegetables and that there are spin-offs from there,
5. Being able to confidently use common pieces of kitchen equipment,
6. Having enough food hygiene and safety so you don't poison anyone, and
7. Being able to assess what is in a products, how to store it and use it. (Vidgen, Gallegos 2011)

A common interpretation by the Australian food experts was that food literacy is either related only to language or to individual empowerment and control, which is implicit to these core components mentioned above. Another finding was that food literacy encompasses knowing, securing and understanding how to use food to improve nutrition, e.g. by giving people more choice, making healthy foods more pleasurable – and thus more likely to be eaten - and improving food security providing greater certainty. These mechanisms of choice, pleasurability and food security were all considered in the context of empowering the individual and providing more control over food and eating. And they relate directly to the individual's values, access and choice surrounding food and nutrition. However, it was stressed that the concept of food literacy should be very contextual rather than universal. (Vidgen, Gallegos 2011) There is in other words a strong link between food literacy and nutrition, with food literacy being able to contribute to improved nutrition.

Other studies with the individual and consumer oriented focus related to food literacy include Pendergast et al. (2011) and Cullerton et al (2012) (Pendergast, Garvis et al. 2011, Cullerton, Vidgen et al. 2012). The review by Cullerton et al (2012) of food literacy interventions targeting disadvantaged young people analyses existing food literacy related inventions based on the 2011 Vidgen and Gallegos food literacy model. The review showed that food literacy interventions are effective in improving some of the mechanisms of food literacy; primarily related to changes in values, increased pleasure and increased food choice. This is seen in direct increases in cooking knowledge, skills and confidence, increased fruit and vegetable intake and reported general dietary change. Yet few studies measured long-term change, but short-term positive effects were seen with most of the interventions. A recent review article by Brooks and Begley (2013) found somewhat different conclusions. They reviewed 19 peer-reviewed papers and four grey literature programs on food literacy, which all focused on interventions targeting 13-17 year olds with the aim of improving their practical cooking and/or food preparation skills in schools and community settings. Although 19 of the 23 studies reviewed reported positive changes, these did not include significant changes in diet quality or cooking frequency at home, concluding that existing food literacy programs with only cooking and practical food preparation activities only to a limited degree

demonstrate positive impacts on dietary behaviour. (Brooks, Begley 2013)

Interestingly, the review by Cullerton et al finds that very few interventions reported improvements in food security and food supply pointing out that this is beyond the control of the individual and that structural factors are more difficult to change (Cullerton, Vidgen et al. 2012). An additional explanation, however, could also be that food literacy interventions to a large extent are focusing on individual or consumer knowledge and skills, but that other broader factors are somewhat neglected. According to Cullerton et al, the interventions that were most successful were those that included either: a gardening component, a supermarket tour (aiding selection of food and thereby decreasing waste), guidance in managing a food budget; and/or the pantry method of cooking (i.e. not using a recipe but using basic ingredients found in a pantry). Of specific interest to this research is the fact that garden-based nutrition education programs for children and youth turned out to be a promising strategy for changing preferences, e.g. trying new foods, improving dietary intake of fruits and vegetables and increasing the likelihood of cooking and gardening in the future. Not only did the programs reviewed by Cullerton et al have the highest number of food literacy mediators and mechanisms, they in fact also made a difference in the difficult food security and food supply areas, thus not only addressing individual factors but also the food environment. (Cullerton, Vidgen et al. 2012)

In the Danish context, food literacy (or food bildung as it is called) is also a relatively new concept. Apart from the focus on knowledge and skills related to food, nutrition and meals also emphasized in the previously mentioned studies, the food literacy/food bildung concept in Denmark is very much linked to the common meal and cooking together as ways of not only promoting food skills and knowledge, but also of providing experiences and fostering curiosity and pleasure related to food and meals. (Wistoft, Otte et al. 2011)

As mentioned in chapter 2, Carlsson and Benn (2010) from the respectively the Danish health education and home economics fields see food bildung within a learning process of four dimensions. This included knowing about the impact of what you eat on your health and the environment, the ability to master daily life and to make healthy meals, wanting to participate in food production issues, problems and engaging in solutions and being able to select meals that are acceptable to others and to interact around a meal. (Carlsson, Benn 2010)

This view on food literacy also implicitly includes the empowerment objectives of the individual. In a conceptual paper on food or nutrition literacy and its implications for home economics, Smith (2009)[13] takes on a broader and more critical understanding of food literacy both in terms of its content but also in relation to the competencies strived at. Gale Smith, a lecturer in home economics education at the University of British Columbia, Canada and researcher in home economics and health curriculum, global education, and action research calls attention to the need for home economics teachers to have an adequate conceptualization of sustainable development and a process

[13] Conceptual paper, not peer-reviewed

for systematically integrating it into their teaching and practices. In Smith's understanding of food literacy, she for instance goes beyond linking food literacy only to nutrition and health, to also making ties to ecological literacy and agricultural literacy related to a deeper understanding of the broader societal context in which our food and eating operates. Furthermore, Smith stresses for food literacy to go beyond the basic knowledge level of understanding to also aiming at the students being able to synthesize, critically analyse and communicate information about food and agriculture based on guidelines, educational resources and projects in the US and Europe. (Smith 2009)

6.1.2. From food consumer to food citizen

Smith (2009) takes on a critical view about the learner often only being seen as a consumer and not a citizen and about the risk of programs only aiming at compliance with existing food guidelines or diet plans. According to Smith, there is a risk when learners are equalled to consumers that it could mean that the program encourages values that are based on seeing food as a commodity, locking the perception of individuals into what Vaines (1994) called "industrial eaters" (Vaines 1994). Linked to the views of Vaines, (1994), Berry (1990) and Pollan (2006) (Vaines 1994, Berry 1990, Pollan 2006), Smith and Mayer-Smith et al. see eating as an ecological act for which reason there is a need for a conception that reconnects people with food and the environment in order to see eating as an ecological and agricultural act (Smith 2009, Mayer-Smith, Bartosh et al. 2009). This correlates with concerns by practitioners (including NGOs, universities, farmers, teachers and government agencies) from the US, the UK, Denmark and other countries, who worry about the lack of knowledge and connections by children and adults to the land and to farming, thereby assuming a role as passive and uncritical consumers. Smith and others join the researchers and practitioners that call for citizens to be food literate in terms of embracing the connectedness and understanding that food and every dimension in the food system and nature are connected:

"The food system interacts with the family system, with the ecological system, with the economic system, with the political system, and so on. We need a conception that explores the socio-cultural-spiritual significance and enjoyment of sharing food and eating together" (Smith 2009) (p.67).

Similar to the concept of food and agricultural literacy and related educational goals applied in this research project, Smith stresses the importance of enabling students to debate, evaluate and judge for themselves – not merely accepting guidelines and advice from others - and connecting the experiences and learning of the students to their own participation, actions and daily lives. (Smith 2009)

Referring to St. Leger's (2001) health literacy understanding (St. Ledger 2001), Smith draws in the empowerment perspective. Lang and Caraher (1999) also highlight this empowerment perspective, specifically in reference to the importance of cooking skills as being an important empowerment process for individuals wanting to exercise control over their diet and food intake by cooking and preparing their own food or by understanding the processes that go into pre-made foods (Lang, Caraher 1999). Cooking skills, gardening skills and other food, health and nutrition related

knowledge is seen to empower people to make informed choices in a fast changing food world. The empowerment perspective is not to the same extent in focus in Denmark in relation to food education, presumably due to the fact that food inequality and loss of cooking skills are just emerging as issues in Denmark.

Understanding the different systems at play related to food, is also present in the Food and Fibre Systems Literacy Standards developed in US in the 1990s, which Powell and Agnew (2011) use in a study to assess the Project Food, Land and People in K–5 grades. The F&FSL standards have been widely accepted as the standards for agricultural literacy in the US as the guideline for infusing Food and Fibre Systems knowledge into core academic subjects and across grade levels. Some of the different systems mentioned earlier seem to also be present in the five thematic areas of the F&FSL standards, namely: 1. Understanding food and fibre systems; 2. History, geography, and culture; 3. Science, technology, and environment; 4. Business and economics; and 5. Food, nutrition, and health. (Powell, Agnew 2011)

An important part of the educational program addressing agricultural literacy is the focus on an educational approach that uses real–life issues for teaching academic skills and knowledge. Infusing agricultural education into the curriculum across subjects is an important objective both in the work of Powell and Agnew and others, and a goal highlighted by both agricultural interest organizations in Denmark developing educational programs as well as some of the farmers interviewed in this research project. This is in other words about the importance of integrating a farm visit and agricultural education and other related thematic areas into the curriculum in e.g. the science classroom.

What characterizes the F&FSL standards and the related lesson objectives in the Project Food, Land and People is the focus on K-5th grade students understanding, recognizing, observing and identifying various ways in which humans rely on agriculture, land and natural resources and eco-systems to meet their needs related to food, nutrition, shelter, clothing, water and for the economy (Powell and Agnew, 2011). Earlier work by Powell, Agnew and Trexler (2008) on a vision for agricultural literacy shows that discussions in the US Agricultural Literacy Special Interest Group in the American Association for Agricultural Education in 2005-2006[14] also considered different approaches to agricultural literacy, which go beyond merely understanding to also being able to think critically in more of a citizens-oriented approach. (Powell, Agnew et al. 2008)

Similar to this Ph.D. project, Powell, Agnew and Trexler (2008) identified three different program approaches within agricultural literacy:

[14] Spurred by criticism in the US of the dominant agro-food system (Powell, Agnew and Trexler, 2008)

1. Infusing agriculture into existing curricula using agricultural contexts as a vehicle to promote academic learning. This is similar to how the science network in case study 3 worked with agriculture. This is called *programmed agricultural literacy.*
2. Integrating agriculture issues in interdisciplinary academic and process skills, while focusing on agriculture. The private school in case study 1 did this by using agricultural themes to develop problem-based project skills. This is referred to as *emergent agricultural literacy*.
3. Students analyse, critically evaluate and discuss the impact of agriculture on the economy, environment and broader society and make decisions to related challenges and choices in society. This is also similar to how the private school in case study 1 worked with agriculture. This was defined by Powell, Agnew and Trexler (2008) as *agriculturally literate value judgments*. (Powell, Agnew et al. 2008)

This illustrate well the different approaches to agricultural literacy and its development in the US and in Denmark, where efforts to define agricultural literacy have moved from mostly technical aspects of production and distribution of agricultural goods to also include the broader environmental, global and social significance of agriculture. This has moved agricultural literacy from conversational and academic knowledge to critical analysis and value-based judgment. Practical knowledge needed to care for outdoor environments and complementing teaching in academic subjects with "*enough knowledge of nutrition to make informed personal choices about diet and health"* (National Research Council 1988) (p. 9). Agricultural literacy is in fact closely linked to experiential education and authentic pedagogy, where the focus is on:

"Experiencing or exploring agriculture as it relates to the subject matter being studied or context of life being lived, and the ability to identify the connections of agriculture to areas of study or life" (Knobloch, Martin 2002) (p.14).

Frick et al. (1991) added the ability to *"synthesize, analyse, and communicate basic information about agriculture."* (p. 52) defined as understanding "*the economic impact and societal significance of agriculture, its relationship with natural resources and the environment, public policies, the global significance of agriculture, and the distribution of agricultural products*" (Frick, Kahler et al. 1991). These definitions are similar to how teachers work with and conceptualize their learning goals in the Danish cases presented in the previous chapter 5.

As mentioned, Smith (2009) and Cardwell (2005) talk of literacy at different competency levels, which although different from the approaches mentioned by Powell, Agnew and Trexler (2008) above, have one commonality, namely the critical literacy dimension (referred to by Powel and Agnew as agricultural literate value judgments). Smith refers to St. Legers levels of health literacy (2001) (p. 201) as: *functional* (communication/transmission of information), *interactive literacy* (development of personal skills and problem-solving) and *critical literacy* (personal and community empowerment) (Smith 2009). Cardwell talks about citizens level literacy, which requires an understanding of literacy at different competency levels: nominal, functional, cultural, and

multidimensional. According to Cardwell, nominal literacy identifies the minimal recognition of concepts (e.g. related to agriculture, nutrition, science etc.). Functional literacy provides the content and understanding of "what." Cultural literacy provides context to concepts and the students' ability to articulate "why." All these three are conditions for multi-dimensional literacy, which gives meaning to concepts and "how" to achieve purposeful actions. (Cardwell 2005) Literacy related to food and health here is in other words to be understood as more than cognitive competence but equally as positional and skills based competencies.

According to Jensen (2002), a Danish researcher in health promotion and environmental education, and findings from my own case studies in Danish schools, teachers almost entirely focus on *what* the current situation is like (the 'what' in figure 8 left) including the historical development. Figure 8 is revised from an earlier figure by Jensen (2002) on environmental issues. Jensen's figure illustrated how most traditional environmental education (and also health education) has focused on students acquiring knowledge of the problems, through a scientific approach and focusing on knowledge about the severity of the problem (left side of figure 8). This type of knowledge is not conducive to action and leaves the student in a state of worry, instead of being empowered and committed to action through understanding the underlying causes and working with change strategies, including hands-on activities and skills, and visions for future change. This is illustrated on the right hand side of the model, where there is a balance between the four dimensions in the knowledge landscape. Jensen advocates for a more balanced focus on all four dimensions of knowledge in environmental education, which include the action-oriented dimensions. (Jensen 2002)

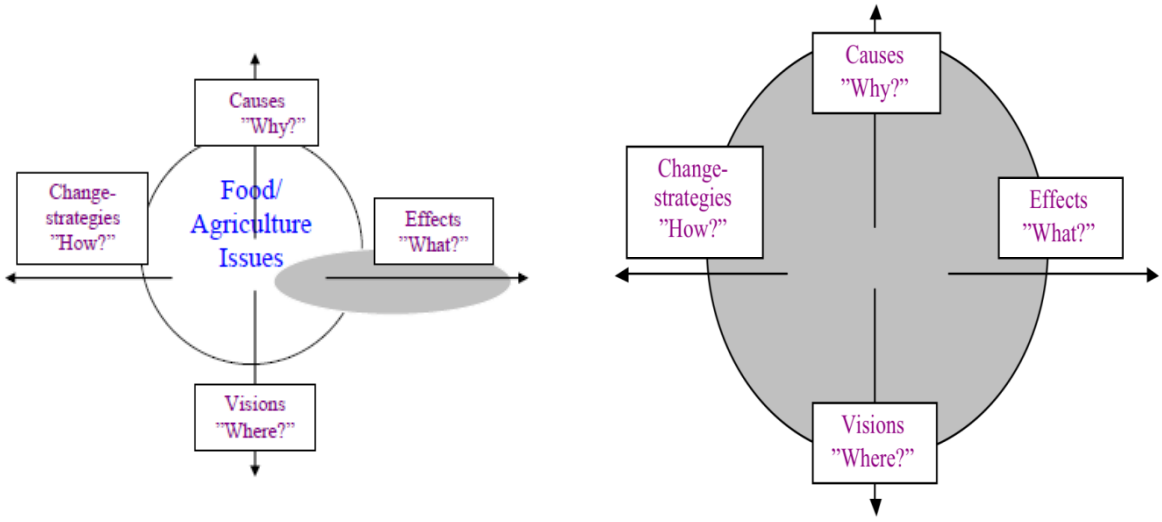

Figure 8: Current and future knowledge landscapes related to agriculture, food and ESD (inspired by Jensen, 2002)

There is also a need to have a more balanced knowledge landscape related to food and agriculture, which emphasize change strategies and visions. In relation to food and agriculture, it is not enough

to understand the problems and challenges (left side of the figure), but also to learn how to analyse the causes of the current situation (the 'why') and develop visions on how to shape the future of food and develop and understand strategies on how to get to the desired state, e.g. by focusing on everyday actions, which students can relate to (right side of the figure). Figure 8 is thus inspired by Jensen's figure and illustrates how the traditional knowledge landscape also tends to dominate in different literacy debates related to food and agricultural issues, where there is also a tendency to focus on the 'what', and less on understanding the underlying factors and how different action- and change oriented strategies and visions can be applied to motivate, engage and empower students.

These four components of a knowledge landscape relate directly to four areas of action competence, which will be further elaborated in the following section. However, in brief, Jensen and Simovska (2005) talk of four important areas:

- *Insight and knowledge:* having coherent and holistic knowledge.
- *Commitments:* refer to the promotion of students' commitment and motivation. This component is closely linked to knowledge in the sense that knowledge about a problem is not transformed into action if motivation and commitment to become involved are absent.
- *Visions:* involve developing visions and creativity related to the future.
- *Action experiences:* are real experiences from participating individually or collectively in activities within a democratic framework and considering how barriers can be overcome. It emphasized the benefit of taking concrete action during the learning process. (Jensen, Simovska 2005)

6.1.3. Action competence and food citizenship

The focus on actions in the context of Cardwell's multi-dimensional literacy and St. Legers critical literacy are both linked with what another education research tradition within health and environmental education refers to as *'action competence'*. As mentioned, the term *action competence* goes beyond knowledge and action experience, to highlight also involvement and co-determination (Elmose 2007). Jensen stresses the key importance of *commitment* in relation to action competence. Knowledge alone – including knowing how to act - will not necessarily lead to any actions – which is why the combination of commitment, experience and knowledge is key. (Jensen 1993) This implicitly means involving students in actions that they have a say in and are committed to, which e.g. a school garden, a student-driven food project or a community project could potentially foster. In the context of Cardwell's multidimensional literacy, the focus is slightly different, however, implying all levels of literacy about food, land, natural resources, and the environment for citizens to "ask the right questions" for public and personal decision-making. (Cardwell 2005)

Developing an understanding of and competence for action, and a drive and connection with others in relation to food is crucial for fostering *food citizenship,* which has become an increasingly

popular term among food and agricultural advocates and environmental circles. Food citizenship can be viewed as the overall long-term goal behind sustainable food literacy from a multi-dimensional or critical literacy perspective mentioned above. Food citizenship is defined by Wilkins (2004) as:

"Engag[ing][students] in food-related behaviours that support rather than threaten, the development of a democratic, socially and economically just, and environmentally sustainable food system" (Wilkins 2005) (p. 269).

In other words, encouraging food behaviours, which are sustainable *socially* (e.g. supporting local farmers, having a say in and a concern about the food system and what one eats), sustainable *economically* (e.g. that producers are paid a fair price, that food is affordable and that health and environmental costs of the food production are not externalized), and sustainable *environmentally* (that the production and other processes in the food system foster agricultural biodiversity, resource conservation, minimization of waste, pollution and CO2 emission reducing effects on climate change). Some of the work done on food literacy and agricultural literacy also emphasize the important link between food literacy and an understanding of broader agricultural, food systems and environmental sustainability aspects of food.(Smith 2009, Powell, Agnew 2011)

As mentioned, food citizenship is about engaging people (in this case students) in food related *behaviour* that supports rather than threaten the development of a socially and economically just and environmentally sustainable food system. Although there is also mention of a democratic food system in the definition by Wilkins (2004), the focus on behaviour has a tendency to focus on the individual as the problem within current unsustainable practices. The concept of 'Food Democracy' on the other hand also acknowledges structural challenges and the rights of citizens to participate in decisions concerning their food systems. According to Lang, food democracy asserts that it is a right and responsibility of citizens to participate in decisions concerning their food system and challenge the corporate structure allowing for bottom-up control of the food system (Lang 2004, Lang 2007). Drawing parallels to the school setting, whose stated aim in the Danish context is to prepare students for co-determination, co-responsibility, rights and duties within a democratic society (Ministeriet for Børn og Undervisning (Ministry of Children and Education) 2013) (paragraf 1 stk. 3), the food area could be a venue to teaching democracy to children – food democracy.

Returning to the concept of food citizenship, it can be viewed as an underlying goal of food and agricultural literacy based on the aim and rationale of critical citizenship or Agriculturally Literate Value Judgments mentioned earlier. Combining the content and educational approaches within food and agricultural literacy with those of ESD can be ways of fostering food citizenship. The connections between food and agricultural literacy and ESD will be further elaborated in the following section 6.2.

6.2. Linking food and agricultural literacy to Education for Sustainable Development (ESD)

Already in 1994, Vahoviak and Etling suggested that *"agricultural education, with linkages to environmental education, could foster an educational philosophy with global sustainability as its focus"* (p. 13) (Vahoviak, Entling 1994). However, initiatives to bring this closer to the daily life worlds of children and other citizens through food, need strengthening conceptually and in practice, although numerous projects already do make some of these linkages. An aim of the Ph.D. project is to investigate the theoretical links between food literacy, food citizenship and Education for Sustainable Development. The following section will look more into the links between food and agricultural literacy, food citizenship and Education for Sustainable Development at the conceptual level and tie this to potentials within farm-school collaboration.

Food citizenship can be viewed as an ideal or normative goal behind food and agricultural literacy – at least if the underlying aim and rationale has to do with critical citizenship or Agriculturally Literate Value Judgments mentioned earlier.

Like food citizenship, Education for Sustainable Development (ESD) [xxii] can also be viewed as an ideal or educational goal:

"to develop the students' ability, motivation and desire to play an active role in finding democratic solutions to problems and issues connected to sustainable development"(Mogensen, Schnack 2010) (p. 69).

To Mogensen and Schnack sustainable development is closely linked to democratic citizenship rather compliance and individual behaviour – and ESD is viewed as a:

"*never-ending process of learning about how to qualify the participants to cope with this citizenship role in a sensible way* " (Mogensen, Schnack 2010) (p. 69).

Inspired by Wolfgang Klafki, Mogensen and Schnack (2010) stress that education - or *bildung* as they refer to from the Nordic and German educational tradition - is not merely about education in the sense of cultivation, normalisation, or traditional socialisation. Rather it also relates to the utopian dimension of critical theory: realizing the full development of capacities and powers of each individual to question preconceived opinions, prejudices, and facts, and participating in shaping one's own living conditions (Mogensen, Schnack 2010): in the context of food – citizens controlling their own food behaviour and influencing the food system.

Although current work on food literacy and agricultural literacy does not apply an ESD perspective explicitly, Smith (2009) and earlier work does take up some dimensions of this (Smith 2009). Vaines (1999) talks about the "*Many Ways of Knowing*" and that when these are brought together - knowing, seeing, becoming and doing including students' life experience (e.g., growing, preparing,

experiencing food with others), and the life experience of others who are close to food (e.g., food producers, food processors etc.) - people can actively participate in creating new stories of growing, acquiring, preparing, using, and celebrating food across generations, within and between cultures in the various places they live (Vaines 2001). This is in other words about participating in creating visions for the future food system.

6.2.1 ESD Principles and learning goals

Food citizenship, food democracy and Education for Sustainable Development are ideals, which cannot be measured. They are situated in what Schnack (2003) would refer to as "utopia" (or a non-place) along with "democracy" and "sustainable development", which are all ideals – something we can strive towards, but not reach (Schnack 2003). However, ESD also has a set of concrete educational principles, which in combination with the content and educational approaches in food and agricultural literacy has the potential of fostering more citizens' awareness and action related to food. The general ESD principles or broader learning goals for primary education (and later in life) by Breiting and Schnack (2009, p. 9) (Breiting, Schnack 2009) are listed below and have been adapted to the food area. They include to be able to:

- participate in considerations and mutual learning about sustainable development.
- consider risks, uncertainties, complexities and long-term and comprehensive global consequences in relation to one's own as well as the practice of others, e.g. in relation to one's food and other consumption choices or in relation to GM foods and global food supply demands.
- acknowledge, reflect and discuss sustainable development as something that requires discussion of values in relation to possible solutions. It is not about deducting *the* "right solution", but about assessing what would be the good and poor actions related to dilemmas and conflicts continuously appearing in relation to long-term development. In the context of food, it could be a discussion of values and pros and cons of purchasing food produced from local farmers or eating imported food.
- analyse limited sustainable development as problems and challenges of understanding social, cultural, economic, ecological, institutional and political structures, dynamic cooperation, power relations, resource distribution and historical courses of development.
- comprehend and handle ecological contexts as well as contexts between societal and ecological development, globally and locally.
- relate ethically, actively, democratically, critically and constructively/innovatively to sustainable development as socio-cultural change processes on all levels.
- think and work in an interdisciplinary, holistic and problem-solving manner.

6.2.2. ESD learning methods

Breiting, Schnack and others working with ESD at the School of Education, Aarhus University, Denmark highlight the following methods and concrete learning situations as being essential:

- Learning through pupil participation, experiences and feeling of ownership for the problem or 'project'.
- Learning takes place through multidisciplinary and holistic problem solving (problem based learning).
- Learning occurs through facilitation of dialogue about everyday practices, values, dilemmas, conflict and choice based on uncertainty
- Learning through working with different perspectives and developing empathy by identifying themselves with others
- Learning occurs through concrete utopian thinking (visions) and critical, innovative processing.
- Learning takes place through experimentation and practical experience as well as related reflection.
- Learning occurs through the use, presentation and critical assessment of different positions of stakeholders and of news from the mass media.
- Learning through working with power relations and conflicting interests, e.g., in the local situation, between countries, between current and future generations.
- Learning through examples that are useful and fruitful in other situations, in opportunities and alternative actions. (Mogensen, Schnack 2010, Breiting, Schnack 2009)

These learning principles can also be applied to food and agriculture teaching and farm-school collaboration and will be followed-up in chapter 7 and 8.

ESD principles in primary education take their point of departure in a citizenship and life world perspective, which, however, go beyond the principles described earlier related to food and agricultural literacy programs. What is especially highlighted and where ESD approaches distinguish themselves from these programs and environmental education are by actively working with student participation, different interests, conflicting opinions and future visions; that there are many futures (or future paths) to choose from. (Breiting, Schnack 2009) According to Breiting and Schnack, it is important that students understand how to analyse different issues, and most importantly their complexity. For this reason, it is important not to convey concrete and finished solutions to the students: but rather for them to learn how to assess different solutions, understanding that there is not one 'right' way, but to relate to dilemmas and being open to several solutions. (Breiting, Schnack 2009)

6.2.3. Learning goals and methods related to food from an ESD and food citizenship perspective

Smith (2009) and Caraher and Reynolds (2005) – all from the home economics field, - however, talk about food within a sustainability and future perspective, highlighting a number of similar principles as the more general ESD principles (which can be seen as an umbrella of educational programs within a sustainability perspective);

- Developing critical thinking skills related to food;
- Addressing multiple problems at the same time;
- Re-skilling to counteract the deskilling that has taken place within food with the rise of the global industrial food market;
- Emphasizing re-investing in community and public spaces as sources of locally grown foods;
- Providing a critical framework for decision-making including questioning the role of food companies in marketing in the educational environment
- Using storytelling and narratives to explore the meanings (e.g., cultural, social, geographical) of food;
- Examining the elements of traditional and local food patterns for those elements that may be helpful for health (of ourselves and the environment) and ecological sustainability;
- Exploring and strengthening our connections to food (including food preparation); and exploring and strengthening our connections to those who produce our food. (Smith 2009, Caraher, Reynolds 2005)

However, they do not integrate future visioning and student participation, which is essential to the ESD learning principles mentioned earlier by Breiting & Schnack (2009).

6.2.4. Food and agricultural literacy from an action competence perspective

In addition to these insights, skills and critical/reflective competencies within food that are stressed above, additional competence related to ESD and action competence is relevant in the food and agriculture area. The following has been inspired by the work of Jensen & Simovska (Jensen, Simovska 2005) and Breiting & Schnack (Breiting, Schnack 2009):

- *Commitments:* refer to the promotion of students' commitment and motivation to work with food issues and to contribute to positive solutions. This component is closely linked to knowledge in the sense that knowledge about a problem is not transformed into action if motivation and commitment to become involved is absent. According to Breiting and Schnack, commitment or mental ownership is critical for further action: that the students get concrete practical action experience thereby developing commitment and ownership. The importance of practical experience, encouraging students' reflections and trust amongst the students in their ability to act are all key factors.
- *Visions:* involve developing visions and creativity of what the food system could be like in general in the future and how society and environment, including the school, could be improved in relation to the food area. It involves working with students' own ideas, values and perceptions about what the future could look like.
- *Action experiences:* are real experiences from participating individually or collectively in food related activities from a democratic perspective. It emphasizes the benefit of taking concrete action during the learning process and how these experiences can contribute to the students' learning and the development of action competence. This could be by having a

dialogue with different farmers, learning how to grow your own food and examining how our food habits impacts health and the environment.

In some school practice, notably school gardens, aspects of Education for Sustainable Development, food literacy and farm-to-table perspectives have a history of being applied to practice. The review of these programs by Desmond et al. (2004) shows that the basis and objectives of these programs (which cover important aspects of what could be the focus of sustainable food literacy) are to:

"Introduce youth to sustainable agriculture and environmental education using the scientific method as a conceptual and hands-on learning process that stresses critical thinking, reasoning and problem-solving. Youth educators thus draw on rich mixture of multidisciplinary topics such as agriculture, natural resources, environmental management, health and human safety, and horticulture. The impact [of various garden- and agriculture-based programs] has been seen through increased knowledge of scientific methods, plants, fertilizer and pests, as well as positive attitudinal and behavioural changes, increased awareness and facilitation of higher order thinking processes." (Desmond, Grieshop et al. 2004) (p. 40)

Building closer links in the food system through the establishment of collaboration between local farmers, schools and students to promote sustainable and healthy food behaviours and actions can provide an important practice field for students to enhance their learning and food literacy - and ideally build food citizenship. It can enable them to see, feel, taste and try out various dimensions of food and connect with local farmers and the soil and field where food is produced. An important lesson from education research and reviews of school food experiences is the important link between learning and experience. According to Dewey, learning is fostered and enhanced through the individual's own actions, thoughts and experimentation in practice and in the surrounding society (Vaage 2000). Action-oriented learning can enable student ownership and develop important action competence (Jensen, Simovska et al. 2005).

Establishing links between the school and local farmers, as part of a local food system, can be an important arena for this kind of experiential education. However, the type and length of collaboration is essential. A study on agricultural literacy and knowledge about the agri-food system amongst Urban Youth by Hess and Trexler (2011) shows that none of the interviewees had ever grown their own food, raised a plant, or cared for an animal. And that in spite of participation in school fieldtrips to farms or a visit to a relative's garden they could not accurately elaborate on the origins of common foods, post–production activities or what happens to food as it travels from farm to plate. A farm visit only is in other words by far enough to provide students with an understanding of the food system. (Hess, Texler 2011)

6.3. Links to broader perspectives on bildung

There are clear historical linkages between the perspectives presented here on food literacy, food citizenship, action competence and ESD to the concept of bildung, which has a centuries-long

tradition in German and Nordic educational theory and practice, as a pedagogical ideal. From a classical perspective, bildung is connected to culture, history, spirituality and related individual behaviour and has traditionally had a tendency to be linked to a fixed, general, normative and bourgeois perspective. (Klafki 1983, Kryger 1994) It is in other words based on a thinking and educational tradition of bildung being linked to a 'right' kind of behaviour, which the teaching strived towards. Even to this day, this view and criticism could also be transferred to the area of food and food literacy, where there is a tendency to view food behaviour from this perspective, i.e. that there is 'right' and 'wrong' food behaviour and values from a prescriptive approach of promoting certain food behaviour either from a nutritional, gastronomic or environmental perspective. Schnack talks about bildung either being related to a socialization or adaptation process as a goal, in order for the child to fit into society and a certain kind of behaviour; or from a distinctly different bildung perspective based on the ideal of educating children to become active and politically conscious participants in a democratic society (Schnack 1994). In Klafki's critical constructive didactics, bildung is about the individual's self-determination, co-determination and capacity for solidarity. This includes determination over one's own life, views, values, religious and career choices, but it also includes one's claims to, possibilities for and responsibility to influence common societal and political conditions. It is based on a learning approach, which promotes the learners' own observations, assessment, reflection and development of opinions and actions (Klafki 2001). It is therefore linked to a democratic or citizenship perspective, which Schnack also adheres to. The role of education from this perspective is not about an adaptation or socialization process towards fixed views and behaviour to fit the system but rather to educate future citizens to understand and reflect on connections in society and act responsibly. It is also not related to a fixed educational content, but a broad one, focusing on action competence and experiences for children to shape their own opinions about society and related actions for change. (Schnack 1994) These educational ideals and roots of bildung from this democratic and societal perspective are in other words broadly related to the ideal of food citizenship and closely to the ESD principles presented in section 6.2.1. and 6.2.2.. The connections between this bildung concept and ESD is that they both not aim to encourage students to do or think something specific; but are rather open, non-prescriptive principles based on working with multiple views, dilemmas and conflicts of interest. ESD, however, is much more future-oriented than the bildung concept.

6.4. Discussion - Food and agricultural literacy and linkages to ESD and farm-school programs

To sum up, different types of literacy concepts, levels of understanding and views on the learner are at play related to food and agricultural literacy both across the two literacies and within each. Food literacy and agricultural literacy both operate either from at an individual level focusing on individual knowledge, skills and academic understanding or on a broader citizen level, which focuses on the ability to critically analyse information and interests, work vision- and future-oriented and engage in actions, thus highlighting the importance of community involvement and personal motivation in working with food and agriculture. However, it is important to stress that it is not necessarily one or the other: the individual level skills and knowledge-oriented approaches

can be combined with a broader citizens and action-oriented approach. There are to some extent overlaps between food and agricultural literacy: agricultural literacy is viewed as a background for understanding the origins of food - and thereby a dimension of food literacy - and is linked with the ability to understand food from a broader societal, technical, economic and ecological perspective - in a sense understanding the individual and individual food preferences, food choices and access as part of a wider food system. In the understanding of the background of food is where agricultural literacy becomes relevant for the individual learner; seeing oneself and one's actions as part of a bigger system of food, which comprises the natural resource/environmental systems, the economic system, the political system and the socio-cultural system.

Chapter 7 Theoretical contribution on food literacy and food citizenship

Based on the insights from food and agricultural literacy, food citizenship and ESD from chapters 3, 5 and 6, this chapter will merge the empirical findings with the theoretical findings to broaden the understanding of and theory related to these key concepts. This chapter will in other words present the results of my theory development based on empirical findings and theoretical perspectives. The figures presented in chapter 5 related to respectively food literacy, agricultural literacy, ecological literacy, food citizenship and sustainability understanding/ESD from the empirical findings have been revised in this chapter to merge the empirical findings and international practice and theory analysed in chapters 3 and 6 into my theoretical development of these terms. The findings from the case studies and theories will help outline and define how farm-school collaboration can contribute to food and agricultural literacy and broader learning goals and values. My contribution is presented on how ESD perspectives can be integrated more consistently in primary education specifically in relation to food and agricultural teaching in 7.3. Finally, my theoretical contribution to food literacy and food citizenship from a broader perspective including also agriculture and ecological literacy and sustainability thinking is presented in section 7.1. and synthesized in section 7.4.

7.1. Theoretical contribution

The empirical findings show perspectives by the stakeholders of what constitutes food literacy and agricultural literacy based on the analysis of learning goals in chapter 5. The theoretical perspectives in international best practice and research were presented in chapter 6. In this chapter, I will merge the empirical perspectives on these key concepts from the learning goals presented in chapter 5, section 5.3.1 and the conceptual findings from theories, studies and practice (in chapter 6) and provide my theoretical contribution to this field.

7.1.1. Food literacy

Findings from the empirical analysis show that food literacy is very much about gaining a broad knowledge about and skills related to food, where the understanding of food production and the farm-to-table process are key components. This differs somewhat from some theoretical contributions e.g. by Vidgen & Gallegos, who have a narrower focus on food skills related to food preparation, access, hygiene, storage etc. (Vidgen, Gallegos 2011). Although Fordyce-Voorham also focuses on individual practical knowledge and skills, aspects like food access and ethical farming and seasonality are also included (Fordyce-Voorham 2011). The food literacy perspectives from teachers and farmers in this empirical study have a strong focus on students understanding and developing skills related to food production and the farm-to-table process, yet with a lesser focus on understanding food from an environmental and food systems perspective. Understanding the many different parts of the farm-to-table process, i.e. the food system, in fact tends to be missing from many existing theoretical contributions on food literacy (except for Smith, 2009) and from the majority of the case studies and food and agriculture teaching materials in Denmark. However, what a few teachers and organizations highlight relate to fostering an understanding the global food system, climate impacts and wider environmental impacts of food production and consumption, e.g.

Climaniacs (film on the global food system), Coop Denmark, The Ecological Council and to a lesser extent the organic producers' association. It is about ensuring that the students learn to see the links between globalization and sustainability (e.g. in relation to food) and their own actions. These are all important issues, which more teachers and educational materials need to address. Around 19-29% of global greenhouse gas emissions come from food consumption and the food system alone, including fertilizer manufacture, agriculture, processing, transport, retail, household food management and waste disposal (Vermeulen, Campbell et al. 2012, US Environmental Protection Agency 2011, Blaser, Robledo 2007). In addition numerous other environmental impacts like soil depletion, loss of biodiversity, pollution of groundwater etc. are also associated with food production and consumption. This calls for solutions also at the consumer and citizen-level.

Merging my food literacy theory development with ESD and sustainability is illustrated as overall learning goals in table 15. Apart from knowledge about food production, the food system, food diversity and nutrition listed in this table (a., b., and c.), I highlight also a number of *practical food skills* and perspectives, such as food growing, preparing and cooking, hygiene practices, being able to read food labels etc. (c., d. and e. in table 15). My emphasis here is on developing critical skills to analyse and act on the information but also on being able link knowledge to concrete actions in students' daily lives. The importance of the student being able to link knowledge about food production, food systems, nutrition and ethical and sustainability considerations to his/her own life and food choice is key to this understanding of food literacy (d., h. and i. in table 15). It includes both knowledge and specific hands-on skills goals like cooking (e.g. cooking a healthy meal, using environmentally friendly resource conserving techniques) and choosing foods and meals that take into consideration environmental, health and other sustainability perspectives (d., h. and i. in table 15). Merging cognitive and skills-based goals with affective and positional goals related to food is important, as it can foster commitment, which is important for any actions and behavioural change. I will come back to this in 7.2.

Table 15: Theoretical perspectives on what constitutes food literacy

a.	Understanding, reflecting and discussing local and globalized food system incl. the farm-to-table process
b.	Knowledge of food uses, food diversity and agricultural biodiversity
c.	Ability to link knowledge of food quality, seasonality, processing, hygiene, labels, nutrition and sustainability to skills in cooking healthy and sustainable meals
d.	Ability to apply sustainability principles and skills in connection with shopping, cooking, dishwashing, cleaning, washing and waste-handling
e.	Understanding of and interest and skills in growing, harvesting, processing, and cooking food and other food related actions
f.	Courage to try new foods
g.	Manners to eat and socialize with others
h.	Ability to acknowledge, critically analyse and act on food labelling, nutrition and food systems information, including health and ethical considerations, environmentally and climate-friendly

	food consumption choices.
i.	Ability to relate sustainability considerations to one's daily life, food behaviour and actions and reflect on one's values related to food.
j.	Ability to and interest in selecting meals that are acceptable to others and socially and environmentally sustainable
k.	Ability to acknowledge eating as a social, political, ecological and agricultural act

The development of individual taste, food courage, manners and skills related to food are also part of my food literacy understanding (f and g in table 15): teacher Bente in case study 3 and institutions like Copenhagen House of Food also highlight this understanding of food literacy or food bildung.

In the theoretical framework in chapter 2, Carlsen's food bildung definition was mentioned. She merges a view on food bildung as both an individual focus related to self-development (i.e. reflections on and development of the individual in terms of who we are, personal taste, skills etc.) with a normative and more community and societal focus. (Carlsen 2011) I would like to stress that exactly this combination of individual focus and a wider community and societal responsibility is important to emphasize in order to facilitate food and agriculture education, which effectively promotes sustainable behaviour related to food. The individual focus is needed in order to initiate and facilitate reflections to make one's food values explicit. However, working with both individual and the societal level and broader systems is needed: as an alternating process between understanding and criticising the food system on the one hand and reflecting on, making explicit and developing one's own actions, preferences, taste and values on the other. Food literacy can in this way be a means to a broader sustainability goal of promoting future eating habits and other actions which are more sustainable.

This food literacy understanding, however, can be viewed more broadly as a means to something else. That something else is food as a platform for teaching broader skills too; life skills to children such as manners, to treat others kindly, to interact with and respect others are highlighted, but also democratic skills or action competence, which I will come back to shortly. There is in other words a combined individual, community and societal focus. This emphasizes the importance of food literacy including and going beyond individual needs to foster responsibility and concern for others and the environment, which essentially is about sustainability.

The focus on individual sensory and skills-based aspects of food combined with social aspects of the meal, selection of foods acceptable to others and foods that are environmentally responsible choices (see j. and i. in table 15) is also highlighted by Carlsson & Benn (Carlsson, Benn 2010). Also from this perspective, and in relation to the integration of ethical and sustainability considerations, there is an implicit shift: from focusing only on the individual's skills and self-

development and empowerment through the development of personal preferences and judgment (as stressed by Vidgen and Gallegos) to also promoting broader ethical responsibility and consideration for others through food and meals. This includes capacity for critical thinking and forming his or her independent opinions and ways of acting based on specific knowledge and skills, but also from a broader sense of global responsibility. These two views on the individual demand different sets of learning goals, teaching methods and underlying values. In both cases hands-on experiential learning, which is relevant to the daily lives of the students, are of benefit. However, the latter requires a broadening in the scope of learning to include wider group and community-oriented learning to foster experience, actions and socially and environmentally responsible behaviour. Farm-school collaboration could be one way of promoting this. However, it cannot stand alone. It needs to be included in pre- and post- farm visit teaching on food and ideally be linked to other ways of integrating food activities at school or in the home (e.g. a garden, canteen, food waste initiative etc.). It also involves working actively with reflections, discussions and solutions related to individual values and actions and its links to broader and global conditions.

Going beyond the focus on the individual and consumer focus to a citizen focus is not about either or; it is about viewing the individual student as both an individual learner, consumer and a citizen, who acts alone and in a social, societal and ecological context. As highlighted by e.g. Pollan and later Smith (Pollan 2006, Smith 2009), this is about teaching students that eating is both an individual act; but it is also about learning to see eating as a social, political ecological and agricultural act through practice (k. in table 15). For this reason, working with and drawing in linkages to agriculture, the food system and ecology is important in order for the students to see and understand these linkages. This could be promoted through farm visits, discussions with farmers in class or on-farm, projects and various on- and off-farm experiments. This point in fact relates well to the findings from the case studies that agricultural literacy and ecological literacy are also important values and broader learning goals for some of the teachers working with food and agricultural education, but not for all.

7.1.2. Agricultural literacy

The importance of agricultural literacy is a new concept from the empirical findings, which is also found in US education research and practice. The theory development related to agricultural literacy is presented in table 16. There are some overlaps in the findings with food literacy, e.g. understanding the farm-to-table process, the food system and food chains (a. in table 16). However, it goes into further details with understanding basic agricultural science, animal science and plant ecology (b. in table 16) as well as understanding the importance of the agricultural sector in history, economy and as a profession (f. and g. in table 16). It includes practical skills like growing your own food and the ability to understand and communicate about different production methods such organic and conventional methods, through hands-on experiences, experiments or farm visits to qualify a deeper understanding of food and agriculture (see i. and j. table 16 below). This is what teachers and farmers referred to in the interviews, as understanding *why* farmers do what they do to understand their decisions. However, there seems to be too much focus on the details of the

production (e.g. during farm visits and in some of the educational materials, e.g. from DAFC) at the expense of broader issues e.g. related to economic, food systems and societal issues (g. in table 16).

Table 16: Theoretical perspectives on what constitutes agricultural literacy

a.	Understanding of agriculture: farm-to-table process, food chains and the food and agricultural sector
b.	Understanding of agricultural science and different production systems
c.	Basic knowledge of plant ecology etc. and animal cycles, behaviour and anatomy, including animal welfare issues
d.	Basic knowledge of biodiversity and uses of livestock, crops and other agricultural products
e.	Basic knowledge of soil composition, fertilization and other factor
f.	Understanding of the agricultural profession and life on the farm
g.	Ability to acknowledge and discuss historical factors, societal and technological development in the food and agricultural sector and the food system at large
h.	Ability to place agriculture within the context of the broader food system, and understand environmental, social and economic factors related to agriculture
i.	Hands-on skills and interest in growing your own food
j.	Knowledge and ability to communicate about different agricultural production methods and one's own opinion, values and choices
k.	Ability to see food consumption as an agricultural and ecological act
l.	Understanding how humans rely on agriculture, land, natural resources and ecosystems to meet their needs

Although there is a strong focus in almost all the cases on teaching students about where their food is coming from (several teachers refer to 'understanding the farm-to-table process'), teaching about the complexity of the food system is largely absent (h in table 16). Instead the main focus is on understanding the agricultural production part of the food system (and the different steps in the production part of the system) and to a lesser extent relating this to the daily lives of the students (e.g. the table and in some cases the supermarket). The only exceptions found with a focus on the farm-to-table process and the overall food system, are found in materials like the Climaniacs film on the long journey of a fish (the global food system), Coop Denmark's material on broader consumption issues, the Ecological Council's materials on respectively meat and fish and to a lesser extent that of the organic producers' association. Only these materials address the global food system, climate impacts and wider environmental impacts of food production and consumption (g. and h. in table 16). This is a significant limitation in the Danish field of food and agriculture education.

Understanding the farm-to-table process or the food system is about more than the production. It is about understanding the different parts of the food system, how they interact and how our food choices influence these parts including the environment (h. in table 16). Needless to say, this is a challenge as the system is global and complex. As mentioned in chapter 3, there are significant

limitations in the understanding by students (and adults) of the food system. The studies by Barton et al. (2005) and Harmon and Maretzki (2006) from the US highlighted the limited ability of students to link food production and the food system to the natural environment and understanding how their food choices in one end of the food system affect other parts (Barton, Koch et al. 2005, Harmon, Maretzki 2006). This is closely related to the learning goal l. in table 16. Farm visits and garden-related activities can connect children with this missing understanding; how nature surrounding the farm, the natural cycles and the food production interact but also how the farmer acts and is influenced by global and local influences. This understanding can be facilitated through tours around the farm, talks with the farmer and experiments, however, only to a certain degree. What many of the materials and teaching in Denmark lack is the ability to present, discuss and reflect over the complexity of our food system especially the global dimensions and impacts globally especially on the environment and socio-economic factors. A farm visit and/or school gardens alone do not include these aspects, nor do the pre- and post- field visit teaching in the four cases.

Although no specific teaching or research studies on children's knowledge of the food system (including this one) have been conducted in Denmark, studies and curricula from the US suggest that there is a great need for this understanding. The Trexler et al study (2000) mentioned in chapter 3, suggested that few students comprehend the complexity of food production, distribution, and preservation system and that they lack an awareness of where their food came from and concern about how it arrived there. An important part of the food systems understanding is how the behaviour of the individual is part of the bigger food system, i.e. seeing eating as an agricultural, social and ecological act affecting the food system and sustainability (mentioned in table 15 and table 16 under k.). (Trexler, Johnson et al. 2000) These findings are similar to a later study by Hess and Trexler (2011) where especially students' understanding of agriculture was underdeveloped, contradictory and based on guesses rather than facts. Few students had grown a plant or raised an animal, although half had been on a farm visit. (Hess, Texler 2011) Trexler et al. also documented that US teachers in the study found it easier to focus their teaching on food and nutrition from an individual focus rather than a broader agri-food systems emphasis (Trexler, Johnson et al. 2000). My findings suggest a similar focus amongst Danish teachers. The study by Harmon and Maretzki (2006) of high school students in the US showed that students found it difficult to see how their own individual behaviour is part of bigger food systems problems and how a choice in one part of the system can have impact on other parts of the food system (Harmon, Maretzki 2006). This is important for understanding how one's own behaviour impacts the system. However, having this understanding is not a guarantee for changes in behaviour. I will come back to this in section 7.2.

Numerous educational materials in the US and related studies address this challenge and attempt to educate future consumers, i.e. children, about sustainability issues and the food system including links between food, agriculture, biological principles and environmental impacts to enable them to make food choices beyond their own health considerations but also taking environmental and other ethical considerations (j) (Trexler, Johnson et al. 2000, Barton, Koch et al. 2005). In fact, several educational materials have aspects of or focus directly on the farm-to-table food system. As an

example, Columbia University's Teachers' College developed a farm-to-table module, 'Farm to Table and Beyond', to teach students science through an understanding of the food system. Prior to this, they did interviews with students, which showed that the understanding of the food system is largely a 'black box' to most students. The aim of this module targeting grades 5 and 6 is therefore to prepare and teach students' knowledge and skills to participate in the public debate about issues related to human impact on the natural environment. Through the perspective of time, the aim is for students to understand the past development of the food system to where it is today, and for them to reflect on and develop creative solutions for the future. Research prior to and after the module suggests that if students develop a solid understanding of the food system, they can apply this to make informed choices not only related to personal health, but also about how to apply this knowledge to promote socially and environmentally responsible behaviour. (Barton, Koch et al. 2005, Center for Food and Environment 2013) This food system understanding and reflections on and creative solutions for the future are linked to the learning goals g. and h. in table 16 on agricultural literacy but also to several of the learning goals in table 15 on food literacy. Here the overall aim is to connect food literacy skills and food citizenship knowledge with ESD principles of understanding time perspectives and actively reflecting on and working with future solutions and actions. It both includes reflective skills and action competence. There is a strong underlying food citizenship learning goal in the abovementioned module, which I will return to when presenting table 18 on food citizenship and action competence. More specific recommendations for how to work with these issues in practice will be presented in chapter 8.

Implicitly in the aforementioned components of food literacy, is also the importance of seeing eating as an agricultural act. This is again related to an understanding of the food system: the awareness of the direct connections between what you eat and its price and the agricultural production and resource use behind your food choices. This is already reflected in some of the underlying goals by the organic producers' association (Organic Schoolyards) and the Ecological Council; that students need to understand that what they eat and the kinds of production methods their food have been produced with have an impact on animal welfare, climate, ecology and other environmental factors. In other words, seeing food consumption as an agricultural and ecological act is already present as a value by some of the green interest organizations. Understanding the importance of agriculture in satisfying key human needs in addition to food, e.g. fibre, fuel, clothing (i. in table 16) (Powell, Agnew 2011) has also been touched on in some of the educational materials by DAFC, but does not really include connections to and importance of land, natural resources and ecosystems behind the agricultural production.

The agricultural understanding related to agricultural literacy includes farm-to-table processes, and overlaps with food literacy. This understanding of the production and food chain is important from both a food literacy and agricultural literacy perspective. The main difference is that in a food literacy perspective is about linking knowledge of the agricultural production (e.g. different production methods and conditions) to how your food choices (e.g. what you eat, the price, level of processing, origin of production, and seasonality) have an impact on agriculture and the environment. The agricultural literacy perspective on the other hand, which is strongly present in all

the case studies and educational materials from DAFC and the organic producers' association and in some of the US studies, has a stronger focus on food as a commodity, agriculture as a production and on understanding this production's economic, societal, historical and global significance, in other words the supply end. Food as a source of nutrition and well-being (the consumer end) is also included but with a secondary focus. Some of the interviews and the review of educational materials revealed a broader interest in promoting an understanding of agriculture as a sector of production and economic activity. This included specific production details, such as the milking system, harvesting techniques, fodder production and farm equipment without being tied directly to an understanding of food or the environmental impact of the production. Thus these farm visits did not have an explicit connection to food. Yet most educational materials make this connection: most include various production details and information about nutrition, labels and recipes at the end. The overlaps between food literacy and agricultural literacy and the differences are presented in table 16: most of the components are strictly related to agricultural literacy except for k, where we see an overlap. However, some of the understanding related to agriculture in table 16 can help qualify some of the food decisions and values, which are mentioned in table 15 under food literacy (e.g. under e.).

7.1.3. Ecological Literacy

In addition to the links between food literacy and agricultural literacy, there are also overlaps between ecological literacy, food and agricultural literacy. The theoretical perspectives on ecological literacy are presented in table 17. Like agricultural literacy, ecological literacy is a term which sums up some of the teachers' and organic farmers' learning goals and values related to the food and agriculture teaching from an ecological perspective. It has not been mentioned theoretically earlier, but was revealed as an underlying learning goal in some of the interviews and teaching materials. This was at least true for those teachers and organizations working with organic agriculture and ecology. Ecological literacy was in general somewhat less prevalent in the Danish cases compared to food and agricultural literacy. Teachers and farmers had an ecological literacy focus in case studies 2 and 4, where they were using educational materials from the Organic Schoolyards program. In addition, the materials and educational practices in school gardens in Denmark both the Gardens for Bellies program and Copenhagen school gardens all have a strong food and ecological literacy focus. This is often tied to hands-on skills in growing your own food, which brings together food, agriculture and ecological literacy perspectives.

Table 17: Theoretical perspectives on what constitutes ecological literacy

a. Knowledge of key ecological principles
b. Knowledge of plant physiology, diversity and uses
c. Ability to understand key concepts within agriculture, ecology and sustainability and connect them to your daily life and food consumption
d. Understanding interactions between farmers, the natural cycle and resources in the production
e. Ability to respect and connect with nature
f. Knowledge of and interest in food, plants, nature and science

g.	Ability to acknowledge food consumption as an agricultural and ecological act
h.	Ability to reflect on how humans rely on agriculture, land, natural resources and ecosystems to meet their needs

The understanding of key ecological principles like photosynthesis and the natural and nutrient cycles and ecosystems (a. in table 17) are important principles for understanding agricultural science (c. in table 17) and different production methods in agriculture, thus bringing together agriculture and ecological literacy perspectives.

Apart from knowledge about various processes and different principles related to ecology, the importance of knowledge about plants can be related directly to understanding plant-based foods and how individual food behaviour influences natural resources and ecosystems. Thus it is about understanding eating as an ecological act, as mentioned earlier (c. and g. in table 17 and mentioned in table 15). The importance of respecting and connecting with nature is essential to ecological literacy (e. in table 17): understanding oneself as being connected to other parts in the systems like plants and insects, and not seeing oneself as separate from the whole. This point was a prevalent learning goal for several farmers and teachers working with organic agriculture in the cases. Respecting and connecting with nature is ultimately about values: teaching children to think beyond personal interests and needs and instead to value all life forms, connecting to and being part of and stewards of nature. This relates to the earlier point about fostering a respect and self-understanding amongst students of their connectedness to and impact of what they do, i.e. of the food choices they make and the food system. In many of the farm- and school garden visits, educators (especially the farmers) work explicitly with values of teaching respect and connectedness to the students.

7.1.4. Food citizenship and action competence

The importance of promoting learners' reflexivity (including value reflections), action-orientation and solution-based thinking in relation to food in some food literacy discourses and practice was mentioned earlier. This is linked to food citizenship and action competence. The theory development related to food citizenship and action competence is presented in table 18. I will include examples of this in section 7.3. and chapter 8. Linking reflective skills and the development of opinions, is linked to the development of values. This is explicitly mentioned in a few of the educational materials related to critical consumption (The Critical Consumer and The Products Leave a Trail/Footprint) and in the learning goals by the Ministry of Children and Education for social science. It is also an important ESD principle to discuss values in relation to possible actions and solutions. Apart from fostering reflective skills and developing opinions and values, it is also about relating students' cognitive understanding of food and their opinions and values to daily sustainable actions (included as b. and c. in table 18).

Experience in communicating views and participating in democratic solutions related to food is also a key part of food citizenship highlighted in a. in table 18. Food citizenship is a long-term goal or

ideal, which I nevertheless see as being an important implicit or explicit goal or value behind food and agriculture education. Here the importance of working with sustainable solutions, visions and engaging students in activities, where they can develop interest, commitment and experience in participating in sustainable solutions is essential (see e. in table 18). None of the cases, however, had a clear underlying food citizenship goal. Yet a few of them, e.g. case study 2 and the rural private school in case study 1 working with an agriculture and food theme in groups, did to varying degree include goals and teaching such as fostering conscious consumers and students with the capacity to form opinions, relate food and agriculture (including organic) to their own lives and work with future solutions. The focus on relating food and agriculture to the students' own lives and working with future solutions are important for engaging students in food related activities and solutions.

Table 18: Theoretical perspectives on what constitutes food citizenship and action competence

a. Ability to communicate views and participate in democratic solutions e.g. concerning food and animal welfare
b. Ability to develop one's own opinions, values and related actions in food and agriculture
c. Ability to relate daily actions of others and oneself to a societal and sustainability perspective
d. Ability to develop one's opinions, communicate personal values and take an active interest in influencing societal conditions/the food system
e. Ability to develop future visions and engage in sustainable food and agriculture actions and solutions in one's own life or wider community

Although many of the teachers interviewed mentioned critical thinking and reflexivity to be an important underlying goal, working more actively with understanding the impact of daily food choices and its impact on the system was not mentioned by any of the teachers. Only in the case of the private rural school working with an agricultural theme in 8^{th}-9^{th} grades was there in a few groups a focus on working with future solutions.

In a fast-changing world with increasing needs for innovation and creative and sustainable solutions to food and agricultural challenges, working explicitly with sustainable and creative actions, solutions and engagement in democratic processes related to food are essential. For this reason, these components have been included as imperative, and are presented in table 18 (specifically a. and e.). This is also closely linked sustainability and ESD in relation to food (presented later in table 19). Understanding and working with food becomes a *goal* in itself. However, teaching about sustainability with action-orientation, solution-based thinking and democratic engagement can also be taught *through* food. Food in this context can be seen as a *means* to teaching citizenship and related skills. Working with concrete actions and solutions is not only important for developing skills and developing alternatives, but also for fostering children's interest and commitment (Breiting, Hedegaard et al. 2009, Jensen 1993). So far this is not part of the food and agriculture teaching in the Danish cases, except to some degree in the student-driven food and agriculture theme on the rural private school in case study 1. These students selected their own themes and

some of the groups worked on identifying future solutions, wrote to the Minister of Agriculture and interviewed farmers to identify their points of views, likely solutions and reflected on their own role related to current and future challenges in agriculture. This was a useful way of engaging the students and enhancing their commitment; by giving the students the freedom to choose angles, contact stakeholders, see different types of agricultural production and develop their own opinions and solutions.

7.1.5. Sustainability understanding and ESD related to food and agriculture

There is generally limited focus on sustainability in the case schools and amongst some of the interest organizations. My theoretical perspectives of working with sustainability and sustainable development topics related to food and ESD principles are presented in the table 19 below. It includes working with global and local issues, future perspectives and dilemmas (a. and b. in the table); this could relate to working with and reflecting on global and local food systems, genetically modified foods, organic agriculture, meat consumption and other topics, which include dilemmas and future opportunities and challenge.

Table 19: Theoretical perspectives on Sustainability understanding and ESD related to food and agriculture

a.	Understanding of current and future food production and consumption risks on nature, environment, climate and humans globally and locally
b.	Ability to understand and analyse sustainable development opportunities, dilemmas and challenges from different perspectives (personal, social, cultural, economic, ecological, equity, power and other perspectives)
c.	Ability to conceptualize, concretize and reflect on sustainability and sustainable development in relation to personal values and food behaviour
d.	Awareness of local community and sustainable food solutions
e.	Ability to critically analyse and understand different views and develop one's own opinions about sustainable food systems and sustainable lifestyle
f.	Ability to develop future visions and sustainable food and agriculture solutions in one's own life or wider community
g.	Ability to think and work in an inter-disciplinary, holistic, future-oriented and problem-solving manner

This is first of all about working conceptually with the students with the terms sustainability and sustainable development. These terms can both be addressed generally and specifically in relation to food and agriculture (b. and c. in table 19). This can be done by making the dilemma of equity between rich and poor, current and future generations in relation to access to food very concrete to the students. An example of this could be to present and discuss the challenges and solutions to the high meat consumption or the long food chains preventing poor farmers from getting a fair price. A key point here is that it should be concrete and that the emphasis should be on solutions rather than on the challenges and putting blame on students. Instead it is about fostering positive commitment and to work with future visions to engage students and involve them in creative, positive ideas for

developing sustainable food and agriculture solutions in relation to their own lives or the wider community (see f. in table 19). Here there is an overlap with food citizenship and action competence.

It is also about actively and explicitly working problem-based and problem-solving with dilemmas, understanding different opinions and interests, different development paths (e.g. through inputs from farmers and other stakeholders) and sustainability challenges and opportunities related to food production and consumption (f. in table 19). This could include hands-on activities on-farm and in the classroom to investigate biodiversity on a farm by;

- Exploring plant and animal species on-farm
- Reading about and investigating historical development, other factors and current interests in the food chain, which influence (agricultural) biodiversity,
- Discussing the dilemmas in priorities, including biodiversity, through collaboration with farmers
- Identifying future challenges and solutions for promoting on-farm biodiversity, including one's own actions as a consumer, dialogue with farmers and/or experiences in a school garden.

Organizing the teaching and the farm visit around a topic like biodiversity could integrate subjects like science, history, biology, social science and home economics to mention a few. Some of the teaching materials mentioned already include angles like understanding species and ecology as well as the historical development. Yet actively working with dilemmas, understanding different opinions and working with future solutions tend to be missing (e. in table 19). Another pressing dilemma, which students could work on, is meat consumption. This is an issue, which brings a whole range of opinions, food preferences, environmental and food security issues, economic interests, globalization and animal welfare issues to the table. This would be beneficial for students to work with. Case study 1 with the 8th and 9th graders at the rural private school was the only example, where **s**ome of these components were included actively in the group process. Several teachers in the other cases mentioned the importance of students forming their own opinions about food and agriculture. But just as important as forming their own opinions is the ability to listen to and understand the opinions of others in order to develop the students' ability for respect, empathy and action competence to reach viable solutions.

7.1.6. Links between the literacies, action competence, food citizenship and ESD

The learning goals illustrated in the 5 different tables related to food literacy, agricultural literacy ecological literacy, food citizenship and action competence as well as sustainability and ESD can be used for inspiration to 5 different curricula, but ideally in a combination between them. As stressed there are a number of overlaps and interrelations between the terms food literacy, agricultural literacy, ecological literacy, action competence, food citizenship and Education for Sustainable

Development in my definitions. In figure 9 I show these interrelationships, including the overlaps and differences between these six key terms of this thesis. The content of each part of the model has already been presented in the different tables in section 7.1. In the figure, the ability to connect specific knowledge, skills and competencies related to food literacy, agricultural literacy and ecological literacy to broader actions and overlapping issues and awareness are illustrated. The broader actions, issues and awareness are about the ethical and ecological ramifications (or sustainability) of one's food choices and actions on a number broader issues from one's own health to broader dimensions of the food system. This is where food literacy moves from being an individual nutrition and health concern and/or matter of personal life skills and academic achievement to becoming a citizens- and collective issue and action-oriented goal. Moving from the bottom and upwards in the figure 9, the demands for more action-oriented and collective focused educational programs increase in order to motivate and foster commitment, visions and future actions amongst students related to food. Experience-based teaching is relevant for fostering individual knowledge, skills and competence as well as collective skills and action competence.

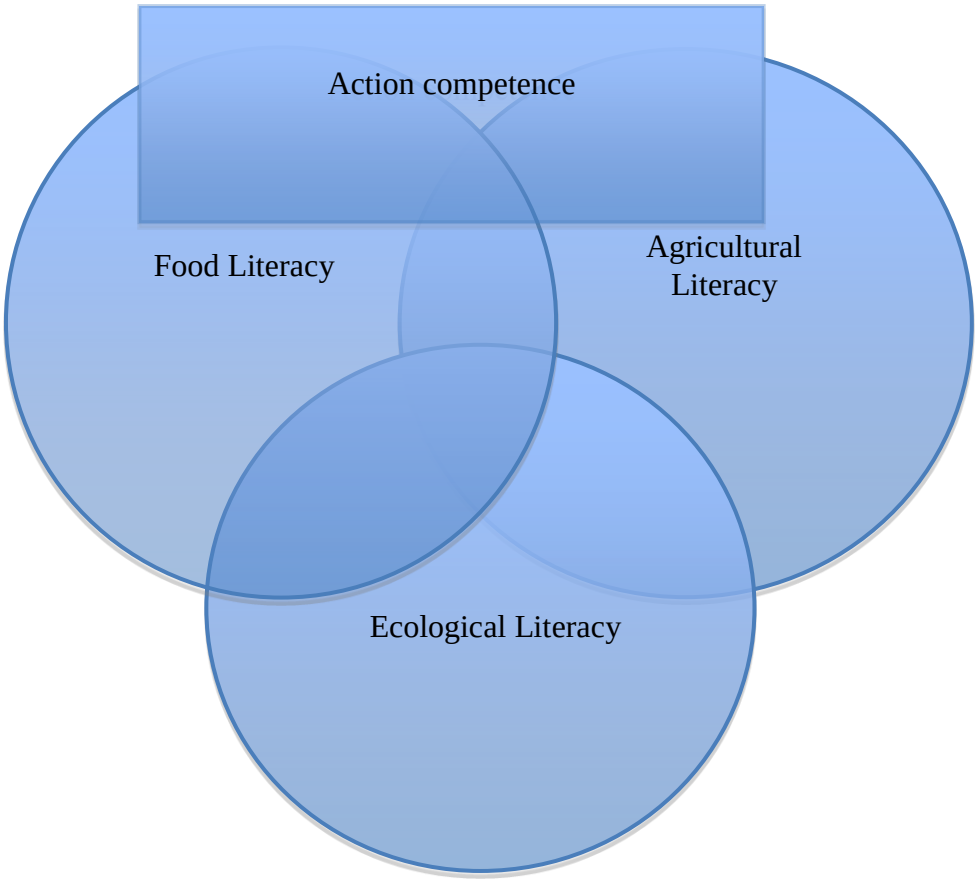

Figure 9: Theoretical model for Food, Agriculture and Ecological Literacies and linkages to Action Competence, Food Citizenship and Education for Sustainable Development

It is well-known that knowledge of food, health and environmental problems are not sufficient for changing behaviour; affective measures and action experiences to foster commitment for change are equally as important. (Jensen 1993, Breiting, Hedegaard et al. 2009)

There is a great demand for theory and practice in food education to view food literacy and related knowledge, skills and competencies from a food citizenship and sustainability perspective; in other words moving beyond the focus on the individual to emphasize the interactions between the individual, society and nature and actions to promote sustainable and responsible food consumption behaviour. This points to an overall need for food and agricultural literacy programs to foster action competence and food citizenship in the long-term and is ultimately closely linked to goals and educational principles of Education for Sustainable Development. ESD is in this figure illustrated as the long-term overarching goal of promoting the ability, motivation and desire of students/citizens to play an active role in finding democratic solutions to problems and issues connected to sustainable development, where the food area is a path to achieving this overall goal. However, ESD are also educational principles, which can be included when working with food and agricultural teaching. Thus it is not only a long-term goal. ESD educational principles can also be

integrated when working with food and agriculture literacy in the lower part of the figure 9, although not depicted in the figure. Integrating ESD educational principles in food and agriculture education is about working with values, dilemmas and conflicts of interest in relation to food, working with utopian thinking, future visioning and critical analysis processes concerning food and agriculture. It also includes working with empathy for current and future generations, e.g. their access to food, water and other natural resources.

The figure 8 in chapter 6 illustrated the need to shift from a generally low to a higher level knowledge landscape. This is also the case with educational programs on food and agriculture. It calls for a transition from focusing on the "what" (descriptive) effects to include an understanding and critical analysis of the "why" (causes), the "where" (change strategies) and the "how" (visions) related to food and agriculture. As of present, there is a heavy focus on the "what" in the educational materials and the actual case examples of teaching. The emphasis on the "why" (critical thinking) in relation to teaching on food and agriculture in the four case studies is less prevalent, although included in some of the educational materials and the teaching in some of the case studies. The emphasis on change strategies and visions is largely neglected, except for some attempts by the students in the private rural school in case study 1 to work with visions for future agriculture and sustainable resource solutions in the rural school in case study 2.

7.2. Food and agricultural education – a platform for building life skills

Development of life skills are part of the purpose of the primary education in Denmark, albeit with the main emphasis on academic skills. Although it is not a key objective, some teachers in the four cases see opportunities in using food and agriculture education as a platform for building personal character and life skills. A few teachers did mention life skills or social skills explicitly as objectives with the food and agriculture education and out-of-classroom teaching, e.g. Annette in case study 2 and Simone in case study 4. In these two cases it was explicitly part of the rationale with the school farm in the organic cooperative (case study 2) and part of the combined teaching, farm visit and student participation in the school canteen (case study 4).

In the US, life skills are included as underlying objectives in many school garden projects and other farm-to-school programs. The integration of food related and academic skills with the non-academic life skills objectives are implicit in many garden - or farm-based programs here. It ranges from more broadly developing leadership skills, group-based collaboration and a sense of community to a focus on personal development, such as finding one's place in the world, learning to take responsibility, learning respect and how to overcome fear by trying something new (e.g. new foods, touching an animal etc.). In some of the online educational resources from the US, life skills are even explicitly mentioned. (The Edible Schoolyard Project 2013, California school garden network (CSGN) 2013, Life Lab Science program Year N/A, Slide Ranch 2013)

As mentioned in chapter 3, there is limited research on the practice and impact of promoting life

skills through garden- and farm-based learning. Nevertheless fostering life skills are often integrated into food and agriculture education programs, although food-, agriculture-, and/or ecological literacy and meeting specific academic learning goals are at the forefront of these programs. Food and agriculture education and farm-based learning is mentioned to be a platform for teaching life skills and broader citizenship skills to students. The many underlying and explicit objectives in food and agriculture education go hand in hand; developing specific academic skills merge with overall food- and/or ecological- and agricultural literacy objectives, which also incorporate the development of life skills and/or teaching citizenship.

Thus food and agriculture education, and specifically the outdoor farm setting, can be used to develop not only citizenship, which has already been covered, but also life skills. As mentioned in chapter 5, life skills are psychosocial abilities for adaptive and positive behaviour. It includes cognitive skills for analysing and using information; reflective skills for negotiating, thinking critically, solving problems and making independent decisions; personal skills for developing personal agency and managing oneself; and inter-personal skills for communicating and interacting effectively with others. The food and agriculture education in the four case studies operate to varying degrees either explicitly or implicitly with some of these aspects. The food and farm education (content) and the outdoor setting can give students experiences and insights, which open up their awareness to herself or himself and the outside world. In a sense, there are connections here to Dewey's experiential learning (Dewey 1938) and Klafki's earlier work on bildung and didactics (Klafki 1983). Also Klafki's critical cognitive didactics emphasized some of the same underlying intentions with general bildung (Klafki 2001), as mentioned above in relation to life skills, albeit with slightly different concepts; he refers to broader goals of self-determination, co-determination and ability for solidarity.

The cases all worked with cognitive, skills-based and affective learning, analysing issues related to food, agriculture, science, nature etc. The farm setting, which demands that students interact with each other, the teacher, the farmer and farm animals and other non-human actors, promotes learning about interacting with others and communicating effectively. This is both within the class with other students and with new actors (i.e. the farmer, the farm animals and other living species on-farm). Thus, it forces the students to behave differently; overcoming fear of the new and being respectful of the new setting and its actors. Several teachers and farmers highlighted the fact that being on the farm strengthens the sense of community in the class, shift roles between the students and can enable new sides of academically weaker students to unfold. There is generally a positive view in the case settings, in other programs and some of the research (Desmond, Grieshop et al. 2004, Waliczek, Bradley et al. 2001, Murphy 2003) about the way in which the farm and garden setting can engage and develop various skills of students, including interpersonal skills, self-development and motivation of weaker students. Learning how to interact e.g. with animals and insects in a calm and respectful manner was highlighted by farmers and teachers as a benefit of visiting a farm. Having said that, one teacher had a more nuanced view on this. She viewed the outdoor setting as beneficial for the academically weak students, but even more challenging when it

comes to students with poor behaviour and short attention spans. Instead of being engaged on the farm or school garden, these students run around and get into trouble in outdoor settings.

Teachers also focused actively on promoting reflective skills and personal skills. In the private rural school in case study 1 with independent student projects, the two schools in case study 2 and the food school in case study 4, all promoted reflective skills related to food and agriculture amongst their students and only expressed to a limited extent a focus on developing personal skills; perhaps due to the fact that developing personal skills is more challenging and abstract and less explicitly in focus compared to other demands and goals. Yet, the research mentioned in chapter 3 and some school garden and educational farm programs in the US emphasize specifically the benefits of developing personal skills through the garden and farm setting. Hands-on activities and real life experiences on the farm (or in a school garden) are seen to promote students' self-understanding, confidence and self-esteem and enable the child to find an understanding of their place in the world and develop emotional and spiritual connections to the social and biophysical world around them (Desmond, Grieshop et al. 2004, Maller 2009, Murphy 2003). This relates well to the experiences by some teachers and farmers in the case studies. They describe how the students discover a connection to the farm animals, insects and plants on the farm and find an engagement in subjects like science as well as a willingness to try new things, which they did not think they liked or dared. This included putting their hands in a cow's mouth, getting their hands dirty, tasting ensilage, trying new vegetables or wild foods etc. This very much suggests that the students experience new situations and a connectedness, which are essential parts of the aforementioned agricultural and ecological literacy goals. Field observations and interviews with teachers suggest a confidence, motivation, pride and ownership amongst the students from their successful experiences in the field, cooking or doing hands-on experiments by witnessing tangible results of their efforts. Even though these personal and social aspects are not explicit learning goal by the teachers except for one, they are, however, key parts of the learning process on-farm, especially after continued visits and school garden programs.

Understanding the relationship between life skills and specifically social learning goals described in this section, and specific content related to food and agriculture (and related literacy) on the other hand can be connected through an understanding of overall educational goals. Although few teachers mentioned it explicitly, some teachers' statements of intended learning were linked to the general stated purpose of Danish public education by the Ministry Children and Education; enabling students to develop consciousness and confidence about their own opportunities and a background for forming opinions and participating as citizens in a democratic society (Ministeriet for Børn og Undervisning (Ministry of Children and Education) 2013). This overall purpose of education has some commonalities with Klafki's understanding of bildung related to self-determination, co-determination and capacity for solidarity. From a didactic point of view, these overall goals, can be converted into concrete learning goals by merging topic-related goals and teaching with interactive and social learning goals. (Klafki 2001) In other words, the overall goals of self-determination, co-determination and solidarity can be taught through merging social learning goals and specific topics in the teaching, with methods and educational resources that emphasize self-reflection, cooperative

learning and experiential learning, democratic and participatory approaches to involve students in decisions.

7.3. Farm-school collaboration - contribution to food and agricultural literacy, food citizenship and ESD

Findings from the case studies provide some suggestions as to how farm-school collaboration can contribute to food- and agricultural literacy, but also some of the short-comings in existing programs and educational materials. In this section, the contribution of farm-school collaboration on students' food- and agricultural literacy and further scope for integrating food citizenship and ESD perspectives further in the teaching and the farm-school collaboration will be discussed. Further recommendations will be provided in chapter 8.

From observations and informal discussions with students and accounts by teachers and farmers, it appears that children develop a better understanding of their food and related agricultural production, when they have been to a farm. However, one farm visit in itself is not sufficient. The importance of pre- and post-farm visit teaching and/or longer collaboration with a farm is stressed by organic farmers in the producers' association, Breiting and Ruge, 2006 (Breiting, Ruge 2006), DAFC and e.g. teachers in case study 3, who developed the teaching program with farmers and other agricultural specialists. Accounts from teachers and farmers, thus, stress the importance of integrating various hands-on activities during and after the farm visit and/or including the farm visit as part of a longer teaching on food and agriculture. Being able to touch and see how their food is produced first hand and seeing or experimenting with growing their own carrots, potatoes and corn, and cooking it afterwards, is exciting and engaging for the students. Meeting an authentic expert in the farmer is both fascinating to the students and an opportunity to ask him/her questions and opinions about the production and the life on a farm. Various themes such as understanding the difference between organic and conventional agriculture can be taught through a combination of farm visits and classroom teaching. Many of the teachers combine the farm visit with pre- and post-classroom integration, where students get to work with food and agriculture from one or several angles, e.g. science, ecology, mathematics and language perspectives and includes food growing, tasting, cooking, nutrition and related activities and topics. Science experiments, cooking exercises, presentations and debates are examples from the case studies. This includes underlying food-, agriculture and/or ecological literacy perspectives and goals.

Framing food and agriculture teaching within a food citizenship rather than a more narrow food literacy perspective offers a number of opportunities, which currently only a few of the teachers make use of. Some teachers mentioned working actively with making connections between the tour around the farm or hands-on activities on-farm and critical thinking, discussions and forming of opinions related to food. It is important that the teacher initiates critical thinking during the whole process, otherwise children will not automatically question what they observe and hear on-farm and later. Integrating critical thinking perspectives throughout the process can enhance the potential for

using the farm visit and related reflections in discussions later on in class and in higher grades. Preparations in terms of asking farmers critical questions, observing with critical eyes and doing follow-up reflections in the classroom afterwards can enhance this critical thinking process. The materials developed for OD by an educational expert for instance included a progression in the teaching materials, where the students are asked to write or draw what they imagined a farm to look like before the visit, observe during the farm visit and then reflect on this and draw their dream farm afterwards. This is one way of igniting reflections for students in younger grades. Initiating critical thinking and forming of values and opinions about food is just part of the big picture of shaping and transforming food consumption in a more sustainable direction. Critical questions to farmers, meeting different farmers to compare production and views and invitations to farmers to come to the classroom are ways of promoting this.

Presenting students to dilemmas and different opinions are also important for developing skills and forming values, which incorporate the educational ideals of ESD and action competence, i.e. working with dilemmas and complexity, conflicts of interest and integrating future visions and actions from a sustainability perspective. A common example of working with dilemmas and differences in opinion is related to organic and conventional production. Often, however, there is a risk of it becoming an issue of choosing one over the other or not being able to convey the complexity in agricultural production adequately; by presenting students to only one type of production due to time limitations or the preference and values of the teacher. As an example of the former point, Laurits in case study 2 only had time to take his students to an organic cooperative, but had the intention of presenting both organic and conventional agriculture equally. Related to the latter point Simone in case study 4 had a clear preference for organic agriculture, which the school was also promoting in their canteen. Neither of them worked actively with different opinions or sustainability perspectives. However, both had an underlying focus on critical thinking and action competence, which some of the other teachers did not. Yet only Laurits saw the importance of presenting both conventional and organic agriculture to the students equally for them to explore and make up their own opinions and understand complexity.

The teachers' values and intentions with the teaching thus becomes a deciding factor for how dilemmas are presented and the extent to which critical thinking, reflections and sustainability issues are included in the teaching. Teachers have limited time and have to weigh different considerations and priorities. In addition, it is a challenge for many teachers to work with the complexity of agricultural production, sustainability themes and action competence for which reason such priorities and principles are not widely integrated into the teaching. Knobloch and Martin documented in a study of elementary school students the importance of teachers having a positive perception about agriculture, e.g. from having taken courses, having agricultural experience or in other ways having had a positive experience with agriculture in order to integrate it into their teaching (Knobloch, Martin 2002). There is an increasing interest in and focus on food, agriculture and sustainability in Denmark. However, tools and experience in teaching these issues e.g. through outdoor experiential education and ESD principles are still rather limited in teachers' education.

Similar challenges appear to be causes of the limited focus on food system perspectives in the teaching. In addition to time challenges, there are limited educational materials available on this topic and understanding the complexity of the global food system is a challenge even for many adults. These appear to be some of the reasons for not including a food systems and globalization perspective in the teaching. Instead the farm-to-table perspective, which is present and mentioned by most farmers and teachers, is restricted to only understanding the primary production. Although only two of the teachers interviewed (case studies 1 and 2) taught students from 7th grade and up, where the food systems perspective might be better understood by students and integrated into e.g. social science or geography, the fact that food systems perspectives were very rare in the educational materials targeting students 7th grade and up, suggests that it is not a perspective, which the big interest organizations like OD, DAFC or the producers' association prioritize.

There are several opportunities in working with integrating ESD perspectives in food and agricultural education. As mentioned working with dilemmas, conflicts of interest and future visions related to what we eat and how it has been produced are good examples of this. In addition to working with different production systems, other topics, which include key dilemmas, conflicts of interest and future considerations, include local and global foods, food miles, seasonality, fair trade, meat consumption, GMOs, fish consumption, food waste, climate friendly foods and agricultural and nutritional diversity. Intergenerational and intra-generational equity issues, i.e. equity between current and future generations, could be included. This will be elaborated in chapter 8. Including a farm visit and other real life experiences could provide an important understanding of some of these issues, e.g. seasonality, local production, environmental sustainability.

However, knowledge of these issues alone will not necessarily lead to changes in behaviour, which is an implicit rationale in most food and agriculture education, especially in terms of aiming to educate children to make conscious, healthy and sustainable food choices. As stressed in the theoretical framework in chapter 2, fostering commitment is critical in any health promotion and environmental education effort, including food education. Knowledge alone will not necessarily lead to any sustainable future actions and behavioural changes. Combining knowledge with experiences and commitment is therefore key in an action competence perspective (Jensen 1993, Breiting, Hedegaard et al. 2009). Also Social Cognitive Theory and Social Learning Theory highlight the importance of emotional, cognitive aspects as well as the environment for learning and behavioural change. Behaviour is influenced by these factors combined, and the environment and observations of others in conjunction provide models for learning and behaviour (Bandura 1977). From a learning perspective based on experiential learning, the farm- and garden-based learning approach to food and agriculture education offers an important opportunity for fostering affective and positional learning and commitment. Almost all teachers and farmers highlighted the fact that on-farm, children learn with all their senses and develop a connection with the farm and the farmer. Petting farm animals, witnessing the importance of worms and bees on-farm, and seeing the farmer as an interesting and authentic expert are examples of this. This is important for fostering an

interest, connectedness, commitment and responsibility by students to food and agriculture. Students can better observe, imitate and identify with the farmer and agricultural production while on the farm. These encounters, which Bandura also highlights as being important for learning, can ideally promote relationships with and respect for farmers, food and nature. Fortunately, farmers are, as mentioned in chapter 4, keen on a dialogue with students, teachers and other consumers.

Commitment can be strengthened or spurred through a sense of community (Jensen 1993). The scope for learning in a wider group and community-oriented learning process to foster socially and environmentally responsible behaviour is there. The collaboration and joint learning model seen in case study 2, 3 and 4, where students can learn about agriculture and food through a closer collaboration with other schools and the agricultural sector or through active involvement in the school kitchen could be expanded to cover food and agricultural issues from a sustainability perspective. Farm-school collaboration and school gardens on- and off-farm offer an authentic real life learning space. This can be used to foster students' motivation and commitment to work with food, agriculture and environment. Moving the teaching out into a farm or school garden, however, will not foster action competence and democratic learning on its own. There is a need for teachers to be guided and trained to gain an understanding of and tools to apply ESD principles including action competence and citizenship perspectives in their teaching. Further recommendations in this regard will be provided in chapter 8.

7.4. Concluding remarks on literacies and food citizenship

Food literacy is both a goal in itself, but can also be a means to something else; a platform for teaching broader knowledge, skills and competencies connected to sustainability, life skills, citizenship and action competence – all of which make up food citizenship. The health, societal, economic and environmental challenges related to food and broader systemic factors demand a shift from an individualized and compartmentalized focus on food, to a broader, systems-oriented and holistic understanding. From a focus on food literacy based on individual knowledge, skills and competence, there is a need also for a holistic emphasis on interactions between the individual, community, society and nature. This emphasizes the importance of going beyond individual literacy to fostering responsibility and concern for others and the environment through a food citizenship focus and process.

There is a demand for a broader awareness, responsibility and actions related to the ethical and ecological ramifications (and sustainability) of one's food choices and actions in a number of areas; from one's own health to broader ramifications in the food system. This is where food literacy moves from an individual nutrition and health concern and matter of personal life skills and academic achievement to becoming a citizenship and collective issue demanding a discussion of and changes in values and action. Thus, there is a need for more food and agriculture education to shift the focus from the individual level to also engage in curricula that address and promote learning and teaching methods, which work with sustainability and food citizenship. These learning

goals have been further developed from my empirical data and analysis as my contribution to the field in figure 10.

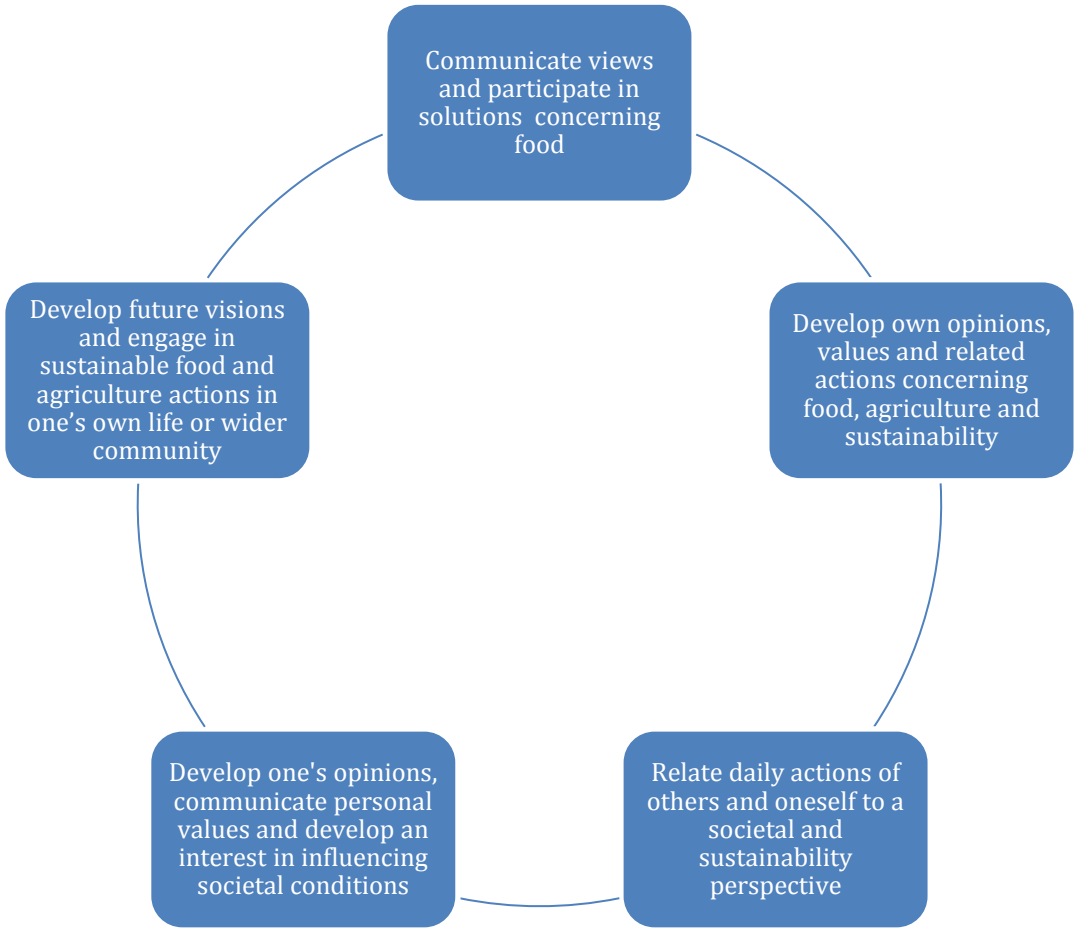

Figure 10: Components of food citizenship

There is in other words a need for learning goals and related teaching methods to focus more on working explicitly with values and concrete actions and solutions. Food and agriculture education needs to emphasize broader sustainability perspectives, citizenship and systems and holistic thinking in an interactive process of learning between developing the individual and his/her understanding of, place in and responsibility towards the world.

For these reasons and based on the dimensions of food citizenship in figure 10, I define food citizenship from a sustainability and future-oriented perspective as:

Food citizenship is the
ability to make connections between your own actions and impact as an individual on broader health, environmental, social and economic factors and an ability, commitment and desire to act to find and engage in sustainable solutions

Based on my definition and the learning goals mentioned in figure 10 and earlier tables, I will present more hands on recommendations to a curriculum that addresses the broader learning goals in chapter 8.

Chapter 8 Discussion and recommendations

In this final chapter, I will discuss and present recommendations for future directions in farm-school collaboration and food and agriculture education. This will specifically be related to stakeholder collaboration arrangements as well as more concrete recommendations on curricula development including content, learning goals and methods, which can be applied in Denmark and elsewhere for furthering the overall aims of promoting food literacy and food citizenship. It is meant as an inspiration to how the theoretical perspectives on food literacy and food citizenship discussed in chapter 7 can be made into a more concrete curriculum. Thus it should be seen as a source of inspiration, not as a fixed curriculum. The discussion and recommendations will be based on the results from the analysis in chapters 4, 5, and 7 but will also draw inspirations in from farm-school collaboration and food and agriculture education in countries such as the US, Norway and Germany.

8.1. Food and sustainability curriculum in Denmark

In the following I will make recommendations on an educational framework/curriculum, which integrates the learning goals and values related to food literacy, food citizenship, action competence and ESD principles presented in chapter 7, incorporating also aspects of agricultural and ecological literacy. Since the main gap in educational resources currently relate to the lack of materials, which incorporate food citizenship goals and ESD principles, the main focus will be on these dimensions. In matrix below I present suggestions on how teachers can work with food and agriculture education, while incorporating learning goals, methods and values relate to food citizenship, sustainability and ESD. The matrix is not meant to be seen as a fixed and prescriptive curriculum, but as a catalogue of more concrete ideas on how to convert the overall educational ideals of food citizenship and ESD into concrete classroom practice. In the matrix, the same learning goals presented in the tables in chapter 7 on food literacy, food citizenship and action competence, and sustainability thinking and ESD are included, but with additional recommendations on concrete content and methods to be used. The underlying values, which each learning goal relates to, have also been included. The educational framework or curriculum is not meant to exclude learning goals related to agriculture and ecological literacy but rather include these as part of the other components, i.e. under a food systems understanding. This contributes with new angles, content and activities, where there is currently a gap. Due to the fact that there is already a wealth of educational materials with a sector-oriented focus, e.g. different types of livestock, meat and other animal products as well as the fact that livestock production is a main contributor to greenhouse gas emissions, the suggested curriculum adds more focus on plant-based production and consumption.

8.1.1. Curriculum for food and sustainability education

Intended learning	Underlying Values	Content	Learning and teaching methods
a. Understanding, reflecting and discussing local and globalized food system incl. the farm-to-table process	Interconnected-ness, systems thinking, transparency	Explore the complex nature of food systems globally and locally. Students investigate sub-systems: agriculture production, processing, packaging, transport, retail and by-products, incl. waste produced in the system.	Depending on the grade level, the teacher and students select a product and work in groups or in class to investigate the food chain/system of the product including food production, processing, packaging, transportation, energy and waste generation. If more groups, the food system related to different foods can be presented. Students are provided with readings and/or movies and will do their own investigation too. Students investigate the price, food miles/country of origin of food product selected and discuss in class the pros and cons of locally and globally produced food. This is relevant for subjects like Science, Geography and Social Science.
b. Knowledge of food uses, food diversity and agricultural biodiversity	Ecological and cultural diversity	Identify F&V that come from different parts of plants (root, stem, leaf, flower, fruit, and seed), different new types of F&V and different varieties of e.g. vegetables (e.g. underutilized varieties).	Visit an organic farm with many different vegetable varieties or establish/use a school garden plot. Students will investigate and describe different function of each plant part, explore and taste, cook with new vegetable varieties and grow their own if possible. Play a game that helps identify and classify various F&Vs and create new, healthy meals. This is relevant for Science and Biology. Supermarket survey of how many F&V are available, country of origin, how many are grown locally, how many varieties are there just within one species (e.g. tomatoes). This could be integrated into an interdisciplinary project involving Science, Home Economics and Geography.
c. Linking knowledge of food quality, seasonality, processing, hygiene, labels, nutrition and sustainability to skills in cooking healthy and sustainable meals	Sustainability thinking. Experiential learning and hands-on skills	Identify nutrients provided by F&V, pulses, meat, fish and dairy; Compare nutrient content of processed and fresh F&V by reading of nutrition facts; Explore different types of labels; Explain the importance of eating a variety of vegs from all vegs subgroups; Compare taste and content of pre-made and home cooked meals; Learn about seasonality of F&V and hygienic handling of food.	Students play a game that helps them identify and classify various vegetables and create new, healthy meals. Students develop an annual calendar of F&Vs in season and compose a meal with seasonal ingredients. Students bring processed foods from home and make a list of ingredients they know and search for information on the internet about ingredients they do not know. Students conduct experiments and observations of what happens to fresh foods left out in the classroom, to gain an understanding of why we preserve food. These activities can be integrated into Science, Biology and Home Economics and thematic weeks on Nutrition and Health.
d. Applying	Interconnected-	Explore the environmental	Estimate energy use related to respectively cooking with or without a lid, boiling water in a water boiler

sustainability principles and skills in connection with shopping, cooking, dishwashing, cleaning, washing and waste-handling	ness, sustainability thinking	impacts (waste, water and electricity use etc.) of refrigeration, cooking, dishwashing, cleaning. Discover ways of handling, reducing and recycling waste etc., saving water and electricity, and understanding labels when shopping.	or in a pot, energy use from boiling eggs/potatoes with a full pot of water or with little water etc. This can be integrated with mathematics by e.g. making an annual estimate of electricity/money saving potentials of applying resource-conserving methods. Could be done at home by individual students or groups. Group projects on food waste reduction at school and/or at home could integrate subjects like Science and Biology on e.g. how to make and keep a compost (e.g. connected to a school garden), Integration of mathematics in terms of estimating and predicting food waste pr. pers. or in total with/without food waste reduction initiatives. Exploration of resources/raw materials used in household appliances and cradle-to-grave process could be integrated into Geography and Science increasing students' awareness of resources and disposal/recycling/reusing/up-cycling of e.g. rare metals/rare earth elements and hazardous waste.
e. Holistic understanding, interest and skills in growing, harvesting, processing, and/or cooking food and other food related actions	Holistic thinking, practical skills	Garden- or farm-based learning for hands-on growing, tending, monitor and harvesting. Monitoring of effects of changing weather conditions on ecosystems, decomposition, seed-to-table life cycle of garden plants. Observe the effects of processing of food vs. non-processing in terms of shelf life.	Establishment of a school garden at school, on a farm or small bed or classroom/window growing with different experiments such as sprouting, fertilization, weeding, monitoring and experiments with soil, light and water conditions, effects of changing weather conditions, monitoring of seed-to-table life cycle of plants. Experiments with shelf life of different types of processed foods vs. fresh foods. All of this could be integrated into subjects like Science, Biology and Home Economics.
f. Courage to try new foods	Food diversity, self-development, openness	Trying new and different types of F&V and new varieties of e.g. vegetables (e.g. local, Nordic underutilized varieties)	Students prepare and taste fruits and vegetables they have grown themselves or brought from a farm during a farm visit. Students try out different types of preparation methods/recipes (raw, boiling, steaming, baking, juicing, puréeing, etc.) adapted to their taste. This could be integrated into Home Economics but also History: talking about the history of various crops. This could be a fun and concrete way of teaching History.
g. Manners to eat and socialize with others	Empathy, kindness, responsibility, community	Social factors and skills surrounding the meal situation.	In Home Economics, students eat the meal they have cooked with cutlery, napkins etc. with the teacher paying attention to commensality, the social life in the class and social skills/manners of the students. This could also be an occasion to talk to the students about different food culture and food preferences.
h. Basic knowledge of plant ecology, animal cycles, behaviour and anatomy, including animal welfare issues.	Theory-practice understandingtransparency	Knowledge and experience through farm- or garden-based learning on scientific principles and natural processes.	Farm- or garden-based experiments with ecological processes, natural- and animal cycles to gain a holistic and scientific understanding through practical examples. Students work with experiments, observations and consultation with the farmer in the farm- or garden setting. Presentation of the findings in the class and/or to the farmer afterwards. Reflections on the findings and how to use them to qualify the students' opinions related to agriculture from a holistic and more general viewpoint (e.g. organic agriculture and conventional agriculture etc.). This would also be relevant for converting theoretical concepts in Science and Biology into practical real life examples and for understanding farmers' production choices.

i. Awareness and critical skills related to food labelling, nutrition and the food system, applying health and ethical considerations, sustainable, environmentally and climate-friendly food consumption choices.	Environmental and social responsibility and aware-ness, Systems thinking, holistic thinking	Present students to knowledge and experiments about food system sub-systems and the various environmental, climate-related, health, and sustainability perspectives.	Students investigate food labels to understand what they mean and say about the product, including nutrition, fair trade, country of origin, production methods (organic, free range, GMO free, MSC etc.). Students then make a farm-to table/food system fair/expo or posters/map of a particular group of products (e.g. dairy/meat, fruits like bananas, avocados, fish, shrimp), including where in the world it is typically produced, processed, packaged etc., fodder and land/water issues, environmental impacts, nutrition considerations, working conditions and other socio-economic impacts etc. They develop their own food-choice guidelines based on what they have learnt, incorporating considerations related to health/nutrition, transport, seasonality, climate, fair trade, etc. This covers some of the learning goals in Home Economics, Science, Geography and Social Science.
j. Ability to relate broader concepts to one's daily life and food behaviour and actions and reflect on one's values related to food.	Personal respons-ibility, commitment to change	Linking some of the broader food system components such as waste to their daily actions to e.g. learn how to reduce food waste	Students conduct hands-on research e.g. by doing waste-analysis investigations and reflecting on how they can reduce their own food waste. This could include studies of how much food and packaging waste are produced by themselves, their families, and communities. They explore how this can be reduced, what can be recycled, reused or composted. They analyse their own personal food habits and reflect on what can be changed here as well. It can be integrated into Science and Biology.
k. Care for and interest in selecting meals that are acceptable to others and socially and environmentally sustainable	Care for others; sustainability thinking	Learn to link considerations of and concern for food preferences of others, and ethical considerations of social sustainability (e.g. fair trade including working conditions and price) and environmental sustainable ingredients when selecting and composing a meal.	In groups the students investigate, discuss and select from different recipes one recipe (or ingredients), which is acceptable to the food preferences and culture of all members of the group through discussion and negotiation. This could include inclusion perspectives of ensuring that individual food needs such as halal and vegetarian foods are considered. Ethical and sustainability considerations could also be included such as environmental impact (e.g. a climate friendly meal) and social factors (e.g. selection of fair trade labelled ingredients or other labels). This is relevant for Home Economics or can be integrated into a Thematic week on Sustainability, Climate friendly food or Nutrition and Health. Alternatively it could be integrated into the activities of the students in the few Food Schools around Denmark, where students are active participants in making school meals.
l. Seeing eating as a social, political, ecological and agricultural act	Connectedness, systems thinking	Exploring the social, political, ecological and agricultural dimensions of food	Students discuss in groups and draw a map of how eating influences and is influenced by social, political, ecological and agricultural factors and vice versa. This would be relevant for subjects like Social Science, Science and Home Economics
m. Develop one's own opinion, values	Food citizen-ship	Considerations related to own values, opinions and	Farm visits or invitation of farmers to the classroom to present their views e.g. on animal welfare, different production considerations (organic, conventional, GMO feed etc.). Students note the views and

and related actions in food and agriculture as well as an interest in understanding the views of others.		actions and the opinion of others including dilemmas e.g. related to meat, GMOs, chemical use etc.	explore opposing views through other farmer contacts or research on the internet. Afterwards, students discuss and reflect on in class or in groups these different opinions/world views and dilemmas and identify their own values and views. A list of ideas and actions on how to link values and opinions to one's own actions. Discuss and experiments with ways of influencing societal conditions, including working with visions, concrete actions, venues for engaging in change. This is relevant especially for Social Science, Science and Biology.
n. Experience in communicating views and participating in democratic solutions e.g. concerning food and animal welfare	Democracy, food citizenship	Students communicate their knowledge and views orally or in writing about a particular topic and discover venues of making their opinions heard.	Student present orally in class their knowledge and opinions about a particular subject like animal welfare, GMOs or climate friendly food initiatives or write comments, ideas or their opinions on different discussion groups on the internet or to a politician to practice communication skills and democratic venues. This could be integrated into Social Science, Biology (especially the GMO debate), and Science or even language subjects.
o. Relate daily actions of oneself and others to a societal and sustainability perspective, including people in other countries and future generations	Sustainable consumption, personal responsi-bility, Empathy for current and future generations	Explore food habits in the class (own and people in other countries) and sources of food from a sustainability perspective (social, economic and environmental)	Students will conduct a weekly diary of what they eat, where the food came from and how it was prepared. Based on this they will investigate the impact of their food habits on nutrition, transportation, energy use, climate, and other environmental footprints, fair trade, local and global economy and other factors. They will do a similar exercise but for a child their age in a developing country. Students make suggestions on how they can improve their impact/find alternatives. Depending on the angle/focus, the activities could be part of Geography, Science, Home Economics and e.g. a thematic week on Sustainability or Food.
p. Foster commitment and future visions to engage in and develop sustainable food and agriculture solutions in one's own life or wider community	Food citizen-ship	Students explore creative, visionary and future oriented solutions related to food and broader issues.	Students are presented to different alternative development paths e.g. through movies/youtube, in addition to farm visits (conventional and organic), visits to urban gardens, school gardens and sustainable communities, they have already been on to explore views and alternative ways of living. Students make a vision board of what their ideal future community, food system or job would look like. They then work on a plan of action to realize this vision, including steps they can take themselves e.g. at home or at the school. This would be relevant for the goals of subjects like Science, Biology, Social Science or a thematic week.
q. Understand and analyse current and future food production and consumption risks on nature, environment,	Connec-tedness	Explore current environmental impacts and future risks related to food production and consumption, globally and locally	A critical examination of the effects of our fossil fuel dependence in food system on the environment. The students revisit how this affects production, transport, packaging, and processing of food. They examine how this affects the environment and global warming. They examine how this impacts locally and globally the air, water and soil, linking these investigations to subjects like Science, Biology and Geography.

climate and humans globally and locally			
r. Knowledge of and ability to analyse sustainable development opportunities, dilemmas and challenges from different perspectives (personal, social, cultural, economic, ecological, equity, power and other perspectives)	Sustainability thinking, actions, systems thinking	Explore and learn about climate friendly and home-made foods, composting, recycling, up-cycling, sharing, food waste reduction, preservation of food, fair trade; explore and critically analyse challenges and dilemmas and future perspectives.	In groups the students work on one action/opportunity, and explore possibilities and challenges, e.g. structural challenges and opponents' views and how to solve these challenges. The students present their project ideas at a fair at the school. This topic and related activities are especially relevant for a thematic week on Food and Sustainability and integrated into Social Science, Home Economics and/or Science.
s. Conceptualize, concretize and reflect on sustainability and sustainable development in relation to personal values and food behaviour	Sustainability thinking and actions	Explore own values and learn about sustainable consumption related to food and meals.	Students explore their own food values and behaviour and reflect on possibilities for personal food sustainability actions. They write in a journal or reflective essay about the opportunities and challenges. This could be integrated into Home Economics, Science and language subjects or an integrated thematic week.
t. Awareness of local community and sustainable food solutions	Sustain-ability under-standing	Discover and experience real life solutions in their local community.	Use the experiences from different field trips, movies and interviews/visits by farmers and others to reflect on different development paths and possibilities for supporting and spreading local actions and rural-urban connections. This could be included in Science, Social Science, Home Economics, Danish or an interdisciplinary thematic week.
u. Critical analysis, understanding of the opinion of others and development of own opinions about sustainable food systems and sustainable lifestyle	Empathy, Sustain-ability thinking and actions	Explore different opinions about e.g. organic and conventional production, rural-urban relations, GMOs, local or global food supply.	The students will interview farmers e.g. during farm visits or invite the farmer to their class ideally both organic and conventional farmers. Alternatively they can explore and compare the views of agricultural organisations and environmental organisations on controversial issues like GMOs, imported feed, animal transports, local and alternative food systems etc. through the internet or writing letter to their communication departments. Students present these different views to each other, relate them to sustainability perspectives (future, environmental and/or equality perspectives) and discuss their own opinions. These topics and activities would be ideal for Science, Biology, Social Science or Danish or an interdisciplinary project.

v. Skills in thinking and working with an inter-disciplinary, holistic, future-oriented and problem-solving manner	Holistic thinking, sustain-ability thinking	Explore a problem and related solution from many angles; science angle, social/humanistic, ethical and spiritual angle and creative/artistic angle	Students work on a particular problem and related future vision/solution for several weeks and explore angels from the perspectives of different disciplines: conducting science experiments and reading, relating it to language, social life and making creative and artistic presentation of ideas and solutions e.g. through the use of film, games, posters, sculptures or inventions. This would be ideal for an interdisciplinary thematic week(s) /future workshop on sustainable development.

The educational framework above is an attempt to connect the identified learning goals to concrete themes and methods to promote an understanding of food, agriculture and sustainability. The ideas presented here are to be seen an inspiration to link knowledge of broader societal issues and challenges related to food, nature and production to children's own life experiences. The framework is both to be seen as having an overall *goal* of promoting students' holistic understanding of and actions related to food, nature, health, food production and consumption. It is, however, also to be viewed as a *means* for teaching broader knowledge, skills and values related to sustainability thinking, connectedness, transparency, responsibility and citizenship. It is also an educational framework that attempts to incorporate the learning goals and values of the different stakeholders, which is an important ESD principle.

In order to not just compile all the learning goals of the stakeholders into one framework, the emphasis has been to also include key gaps, which are not yet sufficiently addressed in the educational materials, in the four cases and in the educational system at large. These gaps are concentrated on the limited inclusion of a food systems understanding and some central ESD principles into the existing teaching. Although it is mentioned in a few educational materials and learning goals, e.g. from the Ministry of Children and Education and DAFC, actively working with, reflecting on and discussing sustainable development in general and as a discussion of one's own values and values in society at large linked to possible solutions, is largely absent.

8.1.2. Systems thinking or holistic thinking

The educational framework includes a column with values linked to the various learning goals. Values included here are connectedness and systems thinking. Systems thinking was not mentioned in chapter 5, but given the importance of 'connectedness' and 'understanding the farm-to-table process' as learning goals, insight into global and local food systems is part of this knowledge: how food, agriculture, economy, policy and ecological systems overlap, the understanding of interactions within and between these systems becomes important. Not only is systems thinking key to understanding the global food system and its subsystems, working with sustainable development requires an understanding of different dimensions and sub-systems e.g. ecological, economic, political, social and cultural ones. According to Sterling (2000), system thinking is linked to ESD, as it is about relational thinking between systems, connectedness and context. It marks a shift from looking more isolated at details and parts to looking at systems within a whole. (Sterling 2000) Understanding different systems and their connectedness (e.g. nature, economy and social systems) are very much at the core of sustainability thinking. Systems thinking requires analytical skills and thinking to understand parts and how they interact within systems and at larger scale. This is e.g. about the ability to analyse how individual or family food choices, affect food production, transport and other parts of the food system and in effect impact climate and other natural systems. Sustainability thinking is in other words closely tied to systems thinking. Smith (2009) highlights the importance of connectedness; between different systems in our understanding of and appreciation for intimate connections between our human lives and health, nature and for the gardens, fields and pastures from which our food comes (Smith 2009).

Yet sustainability thinking is more than systems and analytical thinking. Commitment, affection, creativity and innovation in relation to current and future solutions are ESD principles found in holistic thinking and education. The concept of holistic thinking is often associated with cultural values and thinking in non-Western cultures, such as indigenous cultures across the world. Cultural and holistic values of intuition, trust, reciprocity, creativity, restraint, compassion, human relationships, inter-disciplinarity and interdependence with their environments are crucial values related to sustainability as well (Thaman 2002, Green 2004). Holistic education is linked to ESD and encompasses similar values including; contextual, intuitive, creative, and physical ways of knowing (or intelligences); learning as an inner process of self-discovery and a cooperative activity; interdisciplinary curricula integrating community and global perspectives (Flake 1993, Warburton 2003). Green (2004) stresses that holistic education is about making connections; to self, to community and to the natural world through a process of hands-on learning and reflection, e.g. through school gardening programs (Green 2004). This is reflected in the thinking of educational pioneers like John Dewey, Maria Montessori and Rudolf Steiner, who insisted on education cultivating moral, emotional, physical, psychological and spiritual dimensions of the child; in many ways the broader life skills of a child. The premise that the individual finds identity, meaning, and purpose in life through connections to the community, to nature, to food and spiritual values of compassion and peace resonates well with some of the values identified in the case studies but also with some of the values underpinning sustainability thinking. In business and innovation sectors, there is also an emerging realization that promoting holistic thinking can be a way of fostering innovation and creativity, and the ability to work with uncertainty. Working with holistic thinking is therefore not only relevant in relation to food and sustainability but also as a more general competence relevant for future careers in many fields.

The majority of current teaching and educational materials in Denmark and elsewhere related to food and agriculture is largely focusing on parts without making connections to the whole system or inter-relationships. Rather it is often looking at e.g. livestock and livestock production, which Sanne did in case study 1, or looking at agriculture/organic agriculture in case studies 1-4 with a focus on production. In some cases (mostly in case study 2, 3, and 4), there was also focus on connecting to nature. Although most of the cases link agricultural production with consumption issues, like cooking and health, there is not a focus on broader areas and dimensions (e.g. global and societal issues). Time is a challenge, but the underlying educational approach and the limited experience of teachers are underlying challenges. In case study 3, however, the teachers do aim at presenting the students to different parts and processes in agriculture from a community context (micro-level system). There are connections between the micro-level agricultural production process, the food, student health, the farmer, the agricultural sector, related sectors and the wider local rural community and nature. Similarly, the teachers and farmers in case study 2 link the organic agricultural production system with the ecological system and the consumption system of the students. What is not included in any of the cases (at least only to a very limited extent) is reference to societal and global dimensions (meso and meta-levels); seeing agriculture production and food consumption as part of a wider global economic, environmental and social system.

Sterling (2000) and Lang & Heasman (2004) respectively point to a cultural paradigm shift and a shift away from a productionist paradigm. Lang and Heasman see it in relation to the global food system and food production, where an ecological integrated paradigm based on agro-ecology and sustainability is emerging and competing with a Life Sciences paradigm based on biotechnology (Lang, Heasman 2004). Sterling is talking about a paradigm shift in worldviews. This shift is according to Sterling one of seeing humans and nature from the point of separation, control and manipulation to an ecological paradigm or worldview based on seeing interconnectedness, interrelationships between systems and systems thinking. (Sterling 2000) A few of the organic farmers and teachers visiting organic farms in the case study 2 mentioned interconnectedness as crucial. However, there is a need for the education system, the teaching and the educational materials to address this shift in paradigms to reflect the needs of the future. The shift in paradigms is already seen in the increasing focus in society and in higher education on ecological economics, ecological/sustainable design, sustainable agriculture, farming systems, food systems research, integrated food studies and other interdisciplinary fields. This focus is also found in other areas of society such as in innovation, entrepreneurship and community activities. Thus, competences related to these qualities are increasingly important throughout society. To address interconnectedness, dependence, complexity and uncertainty in today's societies as mentioned requires different way of thinking and a changed focus in education and learning, away from specialized and compartmentalized knowledge. There is much focus in existing educational programs, including the ones studied in the cases, on reflective, analytical and scientific thinking. Sterling argues that 'we live in a Systemic World', yet education is based on fragmentation and understanding the 'what' rather than connections, synergy, relationships and understanding the 'Why', 'How' and 'Where', which Jensen also draws attention to. (Jensen 2002, Sterling 2000)

8.1.3. Learning and teaching methods and future competencies

What kinds of competencies are required in the future? Many of them are addressed in ESD principles and include:

- Capacity to obtain new knowledge and recognize uncertainty. This should ideally be addressed throughout the education, but is addressed in the educational framework in relation to themes on environmental risks (e.g. q. in the framework).
- Ability to see connections and 'the big picture'; seeing links between systems and patterns of behaviour. This can be done by students investigating how their food behaviour affects different parts of the food system, which is highlighted in the educational framework.
- Ability to perceive the world in an ecological and relational way, between parts of a whole including human-nature and local-global relations. The food systems parts of the educational framework are an example of this (e.g. a. in the framework).
- Ability to anticipate systemic consequences of actions, e.g. predicting the potential impacts of particular consumption or technological choices. This is covered under the themes/learning goals d., l. and q. in the framework.

- Ability to value different perspectives, insights and ways of knowing. This is reflected in the educational framework under k., u. and v. for instance in terms of investigations of different stakeholders' tastes related to a meal or views on organic agriculture and conventional agriculture, future food solutions (e.g. GMO and organic) etc.
- Capacity to work innovatively and creatively with visions, solutions and future perspectives. In the education framework, this is included under p. and v., where students work with vision boards of their future community or food system and making creative presentations of sustainable experiments, solutions and ideas.

One way of working more holistically or systems-oriented is by organizing the teaching around themes, challenges and experiences rather than subjects, while integrating different subjects or disciplines within the theme. For that reason, the educational framework includes different subjects under the various learning goals/themes or lessons, which could be a way of including different interdisciplinary and holistic perspectives into the teaching. Students selecting their own themes and/or participating in the decision-making is one way of incorporating participatory learning, which can increase students' commitment.

Although this re-orientation of education has been strongly advocated since the 1992 UN World Conference on Environment and Development and as early as in 1988 in the EU Resolution of the Council and the Ministers of Education meeting, these principles and learning goals are not yet integrated into the teaching in most schools. The UN Decade for Education for Sustainable Development (2005-2014) has also not left a strong mark on teaching practice in schools across Denmark. Some of the ESD principles are integrated into the overall goals for different subjects from 2009 by the Ministry of Children and Education especially in relation to understanding environmental problems based on human-technology-nature connections and interactions between the local and global level. This includes solutions and working with students' own responsibility and actions related to these solutions. The Common Goals (or educational standards), however, are being revised at the moment. The case studies showed that some teachers work with action competence (Laurits in case study 2), student participation (Katrine in case study 1) and developing opinions and action experiences (Sanne, Annette, Laurits, Stine, Bente, and Simone in all the cases). However, there is hardly any focus on future visions, empathy, different opinions, dilemmas, solutions and change-perspective, systems thinking and intergenerational- and intra-generational perspectives.

Learning to work with opinions, conflicts of interest and develop empathy for different views are important principles in ESD. This includes a new set of values and approaches, which are not widely promoted in existing educational programs. As seen in the Danish case examples, there is some focus for instance on developing skills to reflect and form opinions. However, learning to listen to the opinions of others, develop empathy and reach consensus related to dilemmas and conflicts of interest need to be strengthened. This focus on developing students' own opinions, while excluding an attention to the opinions of others, is likely linked to the individualistic society. Sterling (2000) also argues that the limited considerations in Western societies for our neighbours,

community and people in distant environments are replicated in the education system. He calls for a focus on fostering more inclusive and compassionate values in the education system. Experiences from development projects in a few Danish schools to integrate ESD principles in the teaching included working with empathy for current and future generations. The activities used to get students to identify with a child in Guatemala were movies and drawings to imagine living conditions in Guatemala and dolls to imagine and connect with their future grandchildren. (Breiting, Schnack 2009) A similar learning goal and related activities are mentioned under o. in the educational framework. Here students are encouraged to investigate their own food habits but also imagine the food habits of a child in a developing country.

8.2. Future collaboration arrangements

The case studies described in chapter 4 and 5 provided some insights into the opportunities related to farm-school collaboration. Of all the four types of farm-school collaboration, the public school's half-day farm tour in case study 1 is the most common form of collaboration between farmers and teachers. This type of collaboration and the other three models, which are less common, provide opportunities as well as challenges for the future. Some of them were already discussed in chapter 4 and included some of the following areas:

- Political discourse and framework conditions
- School management and structures
- Interest of teachers and schools including dissemination of educational materials to teachers
- Time, transport and economic factors
- Closer collaboration

These points have been taken into consideration in the following sections. Linked to these, there is also an issue related to the development of teachers' qualifications and knowledge of how to use the farm and other outdoor environments and ESD principles in their teaching. Furthermore, the recommendation related to an educational framework, which integrates ESD perspectives, requires an analysis of challenges and opportunities for implementing this. In the following sections, I will therefore elaborate on opportunities and challenges both related to a general strengthening of farm-school collaboration but also specifically in relation to realizing the potentials of the proposed educational framework.

8.2.1. School reform and framework conditions

A political agreement was reached in June 2013 to reform the Danish public school system. The overall changes are about increasing in the number of teaching hours in traditional academic subjects combined with more innovative teaching methods. (Ministeriet for Børn og Undervisning (Ministry of Children and Education) 2013)

The reform includes the following components, which are presented in the boxes on the following pages. These can be seen as opportunities for food and agriculture education and establishing more farm-school collaboration and related outdoor teaching.

The school reform	Farm-school collaboration possibilities	Sustainability, food and ESD possibilities
More teaching hours for Science (Nature/technology), Danish, Mathematics and English. In addition, there are an increased number of teaching hours for creative subjects, incl. new subjects in design and crafts.	This allows more time to work with longer interdisciplinary projects and themes involving e.g. visits to a farm, processing company, supermarket or engaging students in a school garden project.	More time to work with complex issues, systems thinking and dilemmas related to sustainability in e.g. science and design and crafts and other subjects.

The goal of lifting the students academically is, however, not just a question of more teaching hours but also of integrating physical activity and more experiential teaching methods into the school day. More teaching hours in and of itself will not raise the students' academic skills and other skills. However, more teaching hours could open up for more flexibility in the teaching schedule and allow more time for out-of-classroom activities such as farm visits and school gardens and interdisciplinary projects.

The school reform	Farm-school collaboration possibilities	Sustainability, food and ESD possibilities
Approximately 45 minutes per day of *additional time for supporting educational measures including physical activity*. This involves integrating pedagogues in these supporting activities.	Although it is up to each school head how this will be implemented at each school, engaging students in e.g. biking to a nearby farm or doing gardening activities at school could be ways of integrating physical activity during the school week/day in collaboration with pedagogues.	Hands-on gardening activities, learning how to bike and doing other physical activity are both relevant for health promotion, learning in a different way and for teaching students sustainable habits (e.g. growing own food, biking etc.).

There has been a keen interest from the Ministry in lessons-learnt and best-practice from school gardens, farm visits and whole school approaches implemented in a few schools across Denmark. These examples, including the case studies presented in this PhD study are examples of this focus by the Ministry.

The school reform	Farm-school collaboration possibilities	Sustainability, food and ESD possibilities
Focus on *new and innovative teaching to support conventional teaching*, including more project- and product-oriented teaching. The Ministry also focuses on courses to prepare students to handle adulthood through e.g. courses in private economy, democratic participation as well as innovation and entrepreneurship.	Collaboration with farms, local businesses, cultural and educational institutions is encouraged teach theory in practice, develop more experiential learning on a farm and link students' learning to real life issues. Visits to and collaboration with farms, businesses, organizations and educational institutions can also help prepare students for their future studies and careers.	The proposed food and sustainability education curriculum and similar teaching could be an umbrella for student projects or products related to food and sustainability. This could include longer collaboration with local farmer, food business, supermarket or NGO (e.g. nature guide) to do student projects, develop products or visions, where students' creative and innovative skills and introduction to democratic participation perspectives and actions could be integrated.

The new demands of the teachers and school leaders require new competences and support.

The school reform	Farm-school collaboration possibilities	Sustainability, food and ESD possibilities
Development of the competences of teachers, pedagogues and school leaders. This includes funding for teachers' training and support from educational consultants to improve academic skills, classroom management and familiarity with alternative teaching methods of teachers.	Training in outdoor and farm-based pedagogy and experiential learning to get more teachers involved in this and better prepared to use it in their teaching before and after the visits.	Training on how to facilitate student-driven projects, future visioning, democratic processes, working with different local stakeholders, dilemmas, different opinions and development paths (ESD principles) should be part of the teachers' training.

The teachers interviewed in the case studies were mostly self-motivated and had not received any training on outdoor pedagogy except for one. However, it is clear that the majority of teachers need either a training course or on-the job training to build their skills and confidence to implement alternative teaching methods. It is essential to focus on positive scenarios and angles on pressing challenges to avoid frightening students and creating apathy. Working with these issues and alternative teaching methods require a whole other role of the teacher; one of being a facilitator of

the process and involving other stakeholders. It also requires another teaching culture and mind-set away from facts and mono-disciplinarity towards working with uncertainty, complexity and inter-disciplinarity in groups of teachers and others, similar to the practice of the teachers in case studies 2 and 3. In case study 2, three teachers with different backgrounds (science, mathematics, home economics and language) worked together on the organic farming theme related to potatoes which mainly integrated mathematics and science, but could have integrated other subjects as well, such as history, geography and Danish. In case study 3, science teachers in three schools collaborated with a farmer, a nature guide and an agricultural consultant on the development and implementation on a food and agriculture teaching. Although it primarily focused on science, aspects of home economics, history and mathematics were included as well.

The school reform	**Farm-school collaboration possibilities**	**Sustainability, food and ESD possibilities**
More *autonomy at individual schools* to plan and organize the teaching	This can be a way of ensuring a more flexible schedule, which could allow time for longer interdisciplinary thematic weeks or projects and taking students away from the classroom to do various outdoor food and agriculture related activities	This allows time for longer interdisciplinary thematic weeks, student projects and field trips to investigate and explore local stakeholders and initiatives and do role play, presentations and develop hands-on and innovative ideas and solutions.

These are the most essential components of the school reform, which can support farm-school collaboration, ESD and a food and sustainability curriculum.

As mentioned in chapter 4, a central objective of the reform is for students to integrate theoretical knowledge from mathematics, science, biology, home economics etc. to more practical and real life applications. All the teachers in the case studies highlighted exactly this point as being an imperative benefit of farm-school collaboration. For this reason, there are opportunities for realizing more theory-practice linkages through farm-school collaboration as a possible result of the school reform. Teaching programs, which focus on collaboration between schools and farms, schools and businesses, schools and NGOs and other civil society stakeholders are encouraged by the Minister of Children and Education. School gardens in schools and on-farm, visits to food companies and guest talks by farmers (and others) in the school during the winter are therefore important areas, which can be developed. This should be supported by study tours and dissemination of information about successful initiatives across Denmark. The school reform offers possibilities for more flexible teaching schedules to take students out of the classroom as well as attention to and capacity development of teachers to adapt alternative teaching methods. Thus, capacity development of teachers and more hours for out-of-classroom activities to qualify students' theoretical understanding through practice can be used to promote different models of farm-school collaboration and school garden programs.

As described, current learning goals and standards by the Ministry of Children and Education for various subjects do include some aspects of experiential learning, sustainability and ESD. The standards are, however, at the moment being revised and new subjects will be included such as Design and Crafts and Food Knowledge. The latter is a revision of Home Economics, which will focus exclusively on food from an experience-based perspective from which to develop cooking skills as well as interest, knowledge and motivation in relation to nutrition, health, food quality and qualified food choices. The extent to which sustainability, agriculture, ESD principles and experiential learning methods are included in the new subjects and revisions of the old is not clear. However, it can be expected that these standards will reflect such priorities, with the political focus on more flexibility, longer school weeks, innovative teaching methods, connections between theory and practice, outdoor education and collaboration with private and civil society stakeholders.

Having highlighted the opportunities of the school reform for farm-school collaboration and food and sustainability education, it is, however, important to stress that not only does this require a major shift in teaching practice there are also many teachers who are against the reform. This is largely due to the fact that teachers felt excluded from the decisions related to the reform; that their opinions were not heard and concerns met.

8.2.2. Teachers' qualifications and capacity development

At the moment, the key challenges related to strengthening the practice of farm-school collaboration and integration of a curriculum for food and sustainability education has to do with teachers' limited knowledge of and experience in ESD, food systems and outdoor education. The funding for training of teachers and support from consultants to develop teachers' academic ability, knowledge and experience in using alternative teaching methods could easily be linked to garden-based, farm-based and other outdoor education and ESD. Although the teachers interviewed in the case studies used outdoor pedagogy in their teaching, it is likely that many other teachers are not familiar with or confident in using alternative teaching methods.

The teachers interviewed generally had difficulties understanding and making sustainability concrete and relevant especially for students in lower grades, i.e. before 7th grade. None of the teachers were familiar with ESD principles integrating future perspectives, inter- and intra-generational perspectives, student participation, sustainability dilemmas and working with different opinions into their teaching. Although action competence is an educational principle, which some of the teachers were familiar with, the general picture is, that there is a great need for capacity development of teachers in this area. This capacity development should include working with sustainability, action competence (or democratic participation as mentioned by the Minister of Children and Education), outdoor education methods (including working with farmers, companies and others) as well as the key ESD principles mentioned above. Food, agriculture and health could be a cross-cutting area, where these principles can be applied; there are opportunities for linking some theoretical knowledge and abstract concepts (e.g. inter- and intra-generational equity i.e.

future and current generations) to concrete hands-on activities and real life issues. This could be concrete examples of how to reduce your ecological footprint to live more sustainably leaving enough resources (water and food) to your imagined grandchildren or buying fair trade from an African farmer, ensuring a fair price, access to education and proper working conditions. The students can learn to identify with others through role play, movies or imagined stories.

Currently there is a lack of knowledge about ESD as well as an understanding of the importance of and concrete skills to teach students systems thinking, empathy within and across generations, future visions, different development paths and other ESD perspectives. As mentioned, the work of Breiting and Schnack (2009) shows that there are ways of integrating ESD perspectives into the teaching in as low as 3rd grade (Breiting, Schnack 2009).

There is a need for integrating more outdoor learning pedagogy in teachers' education and supporting teachers in the schools with on-the-job competence development by skilled resource persons. At the school in case study 4, the skills development and direct support for teachers have been key components in the transition from a traditional school to a holistic all-day school with a focus on outdoor learning pedagogy and hands-on cooking skills in the school canteen. The school has a counsellor at the school to support the teachers in doing outdoor learning activities. Apart from on-site training, working with teachers colleges is also important. A farmer is already working with one of the teachers colleges (VIA in Jutland). Other teachers colleges have optional modules on outdoor learning or it is integrated into the science teachers' training curriculum or general didactics and pedagogy. However, in general the integration of outdoor teaching methods in teachers education in Denmark is somewhat random. There are in particular opportunities in integrating outdoor education, including farm visits, and food and sustainability education in teachers' education, since young teachers still do not have a teaching portfolio and are likely to be more open to new methods and themes. In addition to that, food is currently a very popular theme in the media in terms of a gastronomy, health/nutrition, back-to-basics and an environmental and sustainable transition discourse, which is likely to inspire an interest amongst some teachers. UCL has also developed an ESD project in the teachers' education to integrate ESD principles in the internship period of new teachers (Breiting, Kaspersen et al. 2011).

8.2.3. Collaboration with farmers and other stakeholders

Working with farmers and other stakeholders on food and farming is not only one of the aims in the school reform it is also an important perspective in ESD and the proposed food and sustainability curriculum. Presenting students to different opinions, e.g. the opinions of an idealistic organic farmer (such as Anne, Inge and Rebecca) and the opinions of a conventional farmer, food business owner or retailer can be one way of conveying different opinions, interests, complexities and dilemmas to students. The stakeholders represent an important role, because they are authentic experts who are passionate about their opinions. During observations of farm visits, it was clear that students were fascinated by this and learnt from these authentic experts. These stakeholders are not presenting their views in an objective or nuanced manner, but with a clear view based on their own

interest, beliefs and values. For this reason, a crucial role for the teacher is to be a facilitator and mediator between these opposing views; ensuring that children write these views down, present them and reflect on opposing views, the reasons behind and the complexity of opinions.

It is, however, important to stress that a close collaboration with the private sector, e.g. organizations like DAFC, the organic producers association and others, also poses some challenges for the students' learning. The school reform disregards the time needed by teachers to establish and maintain a collaboration and plan and coordinate activities with external partners. Furthermore, unless the teachers are able to facilitate this collaboration, draw in different perspectives and ensure that the students are also critical towards what they hear and read, there is a significant risk that such collaboration ends up being more about promoting special interest than qualifying students to become critical and informed citizens. Carlsson and Hoffmann draw attention to this risk by noting that students risk becoming carriers of messages and values of these external partners, e.g. organic farmers or conventional agriculture, and ties this to an adaptive approach to bildung. The school becomes a user of knowledge, with teacher and students adapting the knowledge and views of external partners uncritically. (Carlsson, Hoffmann 2011) If farm-school collaboration is to promote students' food citizenship (or democratic bildung), there is a need for the collaboration and related teaching to be based on critical assessment of stakeholder opinions, students' participation in decisions and actions related to food and agriculture issues at school and at home through dialogue as well as experiences with making their views heard through other democratic channels.

The case studies offered some suggestions as to how to work with other stakeholders and in teams within the schools presented in table 20.

Table 20: Models of collaboration between teachers, farmers and other stakeholders

Collaboration possibilities between teachers, farmers and other stakeholders
Teachers organize visits to different farms (organic, conventional, plant production, livestock production), food companies and supermarkets and older students (8^{th}-9^{th} graders) can visit or interview different stakeholders independently as student-driven projects (case study 1).
Multi-disciplinary teams of teachers work with a cross-cutting issue related to food and agriculture. This could include a longer and more formalized collaboration with a farmer or groups of farmers, which enables the students to follow the growing season and see different types of farms and farmers. This was the case in case study 2. The teaching could be expanded by students looking investigating different sustainability views and impacts of different production methods, including inviting farmers and others into the classroom during the winter to discuss opinions.
Closer institutionalized collaboration between groups of teachers across a number of schools, farmers, agricultural and nature/science experts, local businesses and other stakeholders on food and agriculture education. This was done in case study 3, where the collaboration was on-going with regular meetings, support from school management and incorporated into the annual plans for science in the three schools. This collaboration was supported by the municipality and could

be expanded to include food businesses and NGOs, for students to get a broader view of the food system and be presented to others' opinions.
A Whole-School Approach, where teaching on food and agriculture is integrated with cooking and other hands-on activities in the school kitchen and school garden, combined with farm visits. This could be further expanded by establishing contracts with local farmers for the provision of food for the school canteen. Case study 4 had most of these components except for the food provision from local farmers.

There is generally a large willingness amongst farmers to open their farms to visitors. However, there are differences between farmers in the way they communicate and welcome visiting students. Some students from the private school in case study 1 mentioned in their logbooks that some of the farmers they visited in groups were not very welcoming and informative. However, there are more than 650 farmers on DAFC's website, who have farm tours for the public and students and many farmers are very committed to taking in visitors. Yet, they might not all be as informative and geared towards taking in students. In Norway and Germany farmers and teachers are working in tandem to develop teaching, which is relevant for the students. In this close collaboration, it becomes easier to integrate the needs of the students and teachers in relation to learning goals. Although DAFC staff meets directly with farmers, it is still a challenge to convince some farmers to conduct the farm visit a certain way using DAFC materials. Although these materials have been developed to match the educational goals by the Ministry, it is still based on what the agricultural sector would like the students to learn and not the other way around.

There is a need to present the positive experiences and opportunities in farm visits and other farm-school collaboration, school gardening and related teaching to teachers during their teachers education, in-service training, through educational resources websites and in teaching materials e.g. in science, mathematics, biology, languages, history, social science, geography, arts and other subjects.

8.2.4. Educational materials

The majority of the educational materials reviewed are currently from interest organisations, most of whom have an economic interest in certain angles on food and agriculture, which serve their own interest, whether this is in relation to organic agriculture, conventional agriculture or a mix. This means that certain angles and especially a focus on sustainability issues related to environmental, economic and social dimensions of food, agriculture and sustainability are largely left out, at least from the non-organic interests. Only a few of the materials found were developed by organizations without a specific economic interest, such as the Ecological Council.

In countries like the US, Germany, Norway and Switzerland, some of the educational materials related to food and agriculture are developed by colleges and universities. The benefit of the educational materials being developed through the interest organizations is that they have a good insight into agriculture, i.e. production details and the viewpoints of the agricultural sector.

However, a significant risk is that there is no intermediary or independent entity to help teachers and students critically 'translate' or analyse the information passed on through the educational materials provided from DAFC and the Producers' Association for Organic Schoolyards, or help present different views than what is presented in these materials. This is entirely up to the teacher, which requires insight, time and motivation. Some of the teachers in case study 2 and 3 developed their own educational materials, e.g. through inspiration from the internet, farmers and agricultural staff of DAFC. This material could be disseminated more broadly to other teachers through a common educational portal e.g. the EMU.

Another challenge is that agricultural interest organizations representing conventional agriculture and meat producers are likely to be reluctant to take on a broader systems approach in their educational materials, e.g. inspired by the proposed educational framework presented in 8.1. Having said that, working with ESD is about presenting different development paths, views and futures. For this reason, an ESD curriculum related to food and agriculture could easily present the views and interests of conventional farmers, meat producers and export-driven interests. The key point here is that different interests need to be represented including the conventional sector, e.g. when working with opposing views and future visions related to food and agriculture. As highlighted by Breiting and Schnack (2009) there are many possible futures, some of them more sustainable than others, which we can choose from. Competence to analyse the problems, develop empathy for others, capacity to relate ethically to problems and being engaged in solving problems steering towards the desired future, are all crucial factors. For this reason, active pupil participation and mental ownership to develop this competence amongst the pupils is critical. (Breiting, Schnack 2009)

A problem at the moment is that there is a need to put existing educational materials and the related views and values of the stakeholders into an educational framework. This educational framework (as mentioned in section 8.1) represents different interests (i.e. conventional, organic, local, global food and agriculture), values (eco- and human centred) and works actively to incorporate dilemmas and different future development paths in a comprehensive manner. To realize such an educational curriculum, there is a need for educational materials that represent conventional, organic and export-driven model as well as alternative local, organic, sustainable and/or garden-based food systems and a combination of the two. Educational materials could work actively with a discussion of these different systems, views, underlying values, future visions and different development paths. In a sense the students (future consumers and citizens) need to understand this ideological battle of values and worldviews related to food and agriculture, which is affecting their access to food, health as well as social and environmental impacts. The battle between different values and worldviews is in fact not only of relevance to food and agriculture, but more broadly to the interactions between humans, technology and nature, which food and agriculture themes can help illustrate.

In relation to the possibility of more focus on sustainability in the educational materials, the school service in DAFC mentioned that they are interested in this angle on agriculture. Current commercials by DAFC address future perspectives and sustainability. There is a realization, that this perspective is needed in the educational materials too. The potential for developing materials

with sustainability angles and views by the DAFC could at the very least be a way of presenting students to different views on sustainability in relation to food and agriculture: one from the organic producers' association, which is already available and the views and visions of DAFC related to sustainability, food and agriculture. Views on food, agriculture and sustainability in teaching materials from other organizations like the Ecological Council, Friends of the Earth and other environmental organizations would also be relevant to get a fuller picture.

8.2.5. Time, transport and economic conditions

As mentioned in 8.2.1., the school reform opens up possibilities of having more hours in Science and other subjects (Mathematics and Danish). This could be integrated with an interdisciplinary theme on food, agriculture and sustainability with activities and content organized in a manner that integrates these subjects and lives up to the Ministry's call for more innovative teaching. These longer integrated teaching programs could then incorporate different subjects and include visits to a farm and/or a school garden ideally several times.

A way of handling transportation challenges (distance and cost) is to establish a school garden on the school grounds. This on the other hand requires some start-up and maintenance costs, including teachers', students' and other's time to start and keep the garden. With more weekly teaching hours, the challenge of having enough time for transportation to and from a farm and other companies becomes less of an issue. The economic cost of transportation to a farm or for the establishment of a school garden is, however, a challenge, which continues to be an issue, unless funding is available from the municipality. In Copenhagen, the Municipality is funding the centrally located Copenhagen School gardens (Københavns skolehaver) and Fredensborg Municipality is co-funding the Gardens to Bellies (Haver til Maver) school garden program. The future dissemination of school gardens to other schools and municipalities in Denmark are also to be realized through municipal funds and some private funds. Funding for farm visits continue to be available through DAFC and less frequently through the producers' association for Organic Schoolyards. It is, however, likely with the increasing focus on outdoor education (including school gardens and farm visits), that more schools will be competing for the funds for visits and gardens.

8.2.6. Future collaboration arrangements

The four cases presented some of the possibilities for future collaboration. They each have possibilities in the context of the Danish public school reform.

Farmer-teacher informal collaboration

The short half-day visits in case study 1 is the easiest and least formalized type of collaboration, which is possible for most teachers, if they know about it and see its possibilities. With additional time and focus on new and innovative teaching, a half-day visit to a farm can be more easily incorporated into the teaching and perhaps be extended to a full-day visit. Additional hours for teaching and focus on new teaching methods can be used by teachers to find more time to take their students on several farm visits to both conventional and organic farms and/or visits to food

companies, supermarkets, nature trips etc. This can broaden the students' understanding of the food system and of different views and values. Older students can interview or visit farmers and food businesses independently as was the case of the private school. Farmers could also be invited to come to the school either instead of or in addition to a farm visit to present his/her views, e.g. in winter. With these more informal ways of collaborating, it is however important that teachers work together and share this information amongst colleagues, so information is spread across the school and is not limited to a few highly motivated teachers.

Closer formalized and longer term collaboration between farmers and schools

A more formalized collaboration amongst different farmers and between farmers and nearby schools (case study 2) can be established in other locations. The advantage of this model is that farmers learn from each other and can get a clear sense of how the farm visits with more student-led investigations and activities are integrated into the teaching back at the school. In other words, it is likely that a stronger understanding between the farmer and teacher can be established through a closer collaboration. In the case of the two schools in case study 2, the close collaboration enabled students to do on-farm activities and experiments, which combined practice and theory, making Science more tangible and pertinent for the students. It does, however, demand that the schools and farms are located in relatively close proximity to one another to make more visits feasible. It was not the same students who went every year. However, the mutual understanding between the farmer and teachers had been established by returning to the same farm year after year with new students. This type of longer collaboration can help ensure that teachers become more familiar with and experienced in using a farm visit in their teaching.

Formalized municipal level network between schools and different local community stakeholders

Case study 3 is also a formalized collaboration between science teachers in three schools, a farmer, and local institutions (including a science guide from the science centre, a nature guide from a local nature council and a plant specialist from an agricultural service). This is an interesting model of collaboration because it allows teachers to develop their own educational materials and activities in close consultation with knowledgeable experts. There is adequate time for development, evaluation and further development of the network activities. The experts also have access to different equipment and locations, e.g. seeds, a plough, science equipment, a farm, forest and fire place, which can be used for various experiments. One of the stated objectives of this science network is for it to inspire other schools and municipalities to do the same. The model could be replicated in other areas with moral and financial support from the municipality. Although other municipalities do not have the same conditions, this network model between local stakeholders and teachers, who can develop their academic competence and didactics in collaboration with real experts, can be replicated in other municipalities. This could involve new stakeholders, such as local food businesses, retailers, environmental organizations, educational institutions, researchers or museums ideally some with facilities or room to do out-of-classroom experiments, student-led investigations (of opinions or production factors) or future innovative projects.

Whole school approach and connections to kitchens, gardens, farms and nature

Of all the four cases, the last case is the only with a whole-school approach: being a food school, the teaching about food and agriculture is integrated in different subjects like Science and Home Economics, in students' involvement in the cooking in the canteen and a field trip to a farm. In the future, there are plans to establish a school garden on the premises, to involve the students even further in outdoor learning, gardening and food production. The school has hired a nature guide, who works with the teachers to support them in integrating outdoor learning activities in their teaching. All these components combined would ensure easy access to gardening and cooking activities, which the teachers can use in their teaching. There are currently only a handful of these schools in Denmark. In addition to the food schools, the LOMA Nymarkenskole in Svendborg integrates food education activities, students cooking in the school kitchen, supply of food from local suppliers and visits to farms (Ruge, Mikkelsen 2013).With longer school days in the future, the conditions for combining school food provision and cooking with teaching, farm visits and school gardens are in place. The whole school models are useful for other schools in Denmark. Challenges like funding, space for a kitchen, canteen and school garden, training of teachers, canteen staff and pedagogues are, however, prerequisites for the feasibility of this approach. Establishing more facilities on school premises, such as a school garden, is one way of avoiding transport and time challenges. Being able to work more intensively with food growing to teach students about weather, seasonality, fertilization and other components and using the school garden to teach different subjects, is one way of making the teaching more present and action-oriented. This could be combined with occasional visits to a 'real' farm. Meeting a real farmer as an authentic expert should complement the school gardening activities, e.g. in order to work with critical thinking and food systems perspectives.

New possibilities for networks in food and agriculture education

Apart from these different models of collaboration and possible expansion to include food business etc., there is a need to involve other stakeholders to realize some of the learning goals in the food and sustainability curriculum. These include food organizations and teachers colleges, who can develop educational materials, work with food from a holistic perspective and train future teachers. The availability of more neutral or other angles on food and agriculture educational materials and training of teachers is vital for this to be realized. Involvement of ministries of food and education as well as municipal authorities is important for putting the collaboration on the agenda and facilitating and supporting the establishment of networks.

In the US, Germany and Norway, there are intermediaries or independent stakeholders such as programs and educators from universities and organizations, who develop educational materials and work with teachers or farmers directly, e.g. to develop teaching or training. In some cases, they conduct the farm education themselves with teachers having a more passive role during the farm or garden visit. A benefit of this kind of system is that they are skilled educators, who have a background in working with agriculture, food and nutrition or sustainability. This model is also used in the Danish Gardens to Bellies program and Copenhagen School gardens. These specialized educators can introduce teachers to the educational possibilities of working with food, agriculture

and sustainability. However, this is also a solution that requires extensive resources, not to mention the risk that teachers leave the teaching responsibility to external educators and do not integrate and use field visits later in their own teaching practice. For that reason, training and involvement of teachers in the teaching on-farm and in other out-of-school settings and providing them with ideas on how to integrate garden- or farm-based teaching back at the school is of great importance. Involvement of nature guides, who are trained in outdoor didactics or farmers with a background in teaching, could be ways forward for on-site job training for teachers. Ensuring better access to educational resources could be done by merging the links to outdoor education resources (different organizations' schools services) and teaching materials of different organizations on one common website. This could e.g. be the EMU portal.

Finally, there is a need for a national network for food and agricultural education. At the moment there is no national farm education network. A national school garden network was established recently. There is also a national outdoor education network. It is important to establish collaboration at various levels through a network. Some points of suggestion related to a food and agriculture network are:

- To use the network to let stakeholders meet face to face and learn together
- To develop models of training (especially for farmers and teachers) including certification of training
- To include study visits as part of the network activities
- To ensure that there is a coordination agency/coordinator
- To link network activities with lobbying and contacts to decision-makers
- To ensure that network activities and farm-school collaboration are part of stakeholders' plans and policy, e.g. school profiles and curriculum
- To document network activities and impact of farm-school collaboration to ensure continued support and dissemination of practice.

A joint portal e.g. through EMU, could be useful in order to provide teachers with easier access to information about these different educational resources, networks and outdoor learning programs. At the moment teachers do not have access to a comprehensive overview of educational materials, training and facts related to food, agriculture and sustainability themes and outdoor learning settings.

8.3. Final discussion

With the school reform and an emerging support for and interest in school gardens and other outdoor learning environments, there are many opportunities for development of such teaching programs including methods and educational materials. In spite of the growing interest from ministries (education, food and environment), various food organizations, colleges, universities, agricultural interest organizations, as well as schools and municipalities, the focus on including food and agriculture teaching in a broader ESD perspective is often neglected. The ESD perspective

can bridge and actively work with these different perspectives, values and connectedness related to food and agriculture: bridging and connecting the interest in food literacy (the food discourse), with the agricultural literacy (agriculture discourse) and the ecological literacy (ecology/nature discourse), which the different stakeholders (teachers, farmers and organizations) can be placed within.

Regarding the collaboration models presented here and in chapter 4, there is much to be learnt from these cases for further integration of farm visits into the education. Combining school gardens with visits to real farms is a unique opportunity for combing frequent outdoor garden-based teaching on food growing, experiments and cooking using an Udeskole approach (outdoor learning) with visits to real farms and other visits. This and other action based learning can expand students' food systems understanding and learning about farming and other professions. The *relative* closeness to farms, willingness by farmers to take in students combined with the Danish school reform's focus on alternative teaching methods and more science, mathematics and other relevant subjects opens up a wealth of possibilities to develop this area in the future.

8.4. Conclusion

The findings show that there is a connection between the motivation of farmers and teachers and the way in which they collaborate, i.e. how closely they collaborate. If the aim was to increase transparency and understanding of where the food is coming from, the collaboration tended to be short and less formalized. If on the other hand there was a focus on enhancing experiential learning, theory-practice relations and connectedness to nature, the collaboration was typically longer and more formalized. There is also a connection between the motivation and the learning goals and the learning goals and values: e.g. if the learning goal was related to knowing where the food comes from, it either was connected to a value of transparency (in the agricultural sector) or of connectedness (to the food production and to nature).

The PhD project investigated four different models of farm-school cooperation and related networks. This ranged from less formalized networks of just a farmer and individual teachers in case study 1 to models of close collaboration in case study 2 and 3; either between different farmers and a long-term collaboration with schools, or a formalized multi-stakeholder collaboration in case study 3 involving several schools, a farmer, nature guide and science centre. The last case study had a whole-school approach to food, mainly involving a cooperation within the school between teachers, kitchen staff and a nature guide as well as a loose collaboration with a farm. There was a link between the type of collaboration and the underlying motivation of the teachers, farmers and interest organization. There are numerous opportunities with the new Danish school reform of spreading these different collaboration models to other schools, possibly combined with school gardens. There is, however, presently not a national network in farm-school collaboration, and the exchange of experiences, training and support is not systematic or organized to the extent seen in other countries such as the US, Norway and Germany.

Farm-school collaboration and related teaching can contribute with perspectives on food-, agricultural- and ecological literacies and food citizenship. In practice, farm-school collaboration can be integrated into a curriculum for food and sustainability education. Current collaboration with farmers as well as food and agriculture education in schools do not integrate themes or educational principles related to Education for Sustainable Development, which are at the core of the thinking and competencies demanded of future individuals; whether these are seen in the perspective of future employees, consumers or citizens. Citizenship and action competence are aims, which some teachers work with. However, there are many new opportunities for teaching about food and sustainability through different forms of collaboration with farmers and possible partners that are integrated into a food citizenship and ESD agenda. The ultimate goal of food and agriculture education in the future should be to promote food citizenship, which I have defined in this Ph.D. study to be: "*the ability to make connections between your own actions and impact as an individual on broader health, environmental, social and economic factors and an ability, commitment and desire to act to find and engage in sustainable solutions.*"

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Endnotes

[i] In one of the cases, teachers were interviewed who worked with integrating farm visits and agricultural topics in all 4th, 5th and 6th grades in their respective schools.

[ii] The "Haver til Maver" or *"Gardens for Bellies"* program is farm-to-table non-profit programme by the organic food home delivery company Aartiderne. This school garden program has been set up to enable children to learn about food, agriculture, gastronomy/cooking and healthy food habits, through growing their own food at the farm and cooking the home-grown food. http://havertilmaver.wordpress.com/haver-til-maver-dk/

[iii] The Whole School Approach aims to integrate formal and non-formal curricula with institutional practice, social and organizational aspects and making links to the local community surrounding the school. Integrating the social/organizational and/or technical/economic aspects of school life includes e.g. students' participation in decision-making processes, cooking activities and other activities related to the structures, buildings and decision-making within the school setting and in the broader community. (Shallcross and Robinson, 2008)

[iv] Ecological and educational theorists referred to here were e.g. Capra, 1999; Cramer, 2008; Green, 2004; Hart, 1997; Montessori, 1967; Moore, 2000; Moore and Wong, 1997; Steiner, 1970, Heerwagen and Orians, 2002; Kellert, 2002; Kellert, 2005.

[v] The original Danish title of these organizations are: Landbrugsraadet, Danske Slagterier, Dansk Svineproduktion, Dansk Landbrug, Dansk Landbrugsmedier, Dansk Landbrugsrådgivning and Mejeriforeningen

[vi] This number includes number of students visiting from August-28 November 2013 and does not include the full school year 2013-14.

[vii] The map of DAFC school farms only includes farms under DAFC and does not include other school farms, e.g. the ones under OA.

[viii] Coop Denmark is a member owned organization, which owns retail stores across Denmark.

[viii] Arla Foods has production facilities in 12 countries, more than 18,000 employees and sells their products in more than 100 countries but with their core markets in Denmark, Sweden, The UK, Finland, Germany and The Netherlands.

[ix] Grundfoss is a Danish-owned international company, and the world's largest manufacturer of pumps, such as circulation pumps. The company has more than 14,700 employees across the world, but its headquarters is located Denmark.

[xi] Referring to the much debated practice of animal transports, where e.g. piglets are born in Denmark and then sold and transported to German farmers or where larger animals are transported to Germany, Poland and other countries because it makes economic sense to transport them for sales or slaughter in other countries.

[xii] Lærkevang was a milk brand from Arla Foods that was based on milk from dairy cows who had been reared part of the year on grass. This was, however, changed due to the fact that Arla Foods realized that consumers were more concerned with freshness than animal welfare: https://www.facebook.com/ArlaDanmark/posts/544617088884161

[xiii] Kvickly is a supermarket.

[xiv] Kiwi is the name of a supermarket

[xv] Schulstad is the name of a bread manufacturing company.

[xvi] The name of a forest area with a Viking settlement used for teaching outdoor nature education.

[xviii] A pixi book is book in a small children's book format, which has become a popular series of children's books. It has the same status in Germany to that of Western Publishing's "Little Golden Books" in America. It is a familiar, well-loved format for storybooks measuring 10x10 centimetres.

[xix] Science is taught in Denmark from 1st through to 6th grade. Biology is taught from 7th through 9th grade. All the interviewees integrated food and agriculture teaching in science or biology, sometimes combined with Danish and Mathematics.

[xx] The Food Land and People project educates students, teachers and citizens about the interrelationships between food, resources and people. It was established in 1989 and now based in Tallahassee, Florida. FLP is a non-profit organization committed to providing educational materials serving Pre-K to 12th grade students throughout the United States.

[xxi] The food experts were from sectors like nutrition, education, welfare, gastronomy, food production food industry. The sector participants came from research, practice, policy and advocacy.

[xxii] Education for Sustainable Development (ESD) is an umbrella of educational activities around the world related to sustainable development based on the idea of implementing programs related to local environmental, economic, and societal conditions that are locally relevant and culturally appropriate. ESD was first described in Chapter 31 of the 1992 UNCED Agenda 21, highlighting the importance of improving basic education, reorienting existing education to address sustainable development, and developing public understanding, awareness, and training.